

# MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

FEBRUARY, 1889.

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1889.

List of merchant marine steam and sailing vessels from which International Meteorological reports were received at the office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of February, 1889.

Name of vessel.	Captain.	Name of vessel.	Captain.	Name of vessel.	Captain.
Am. s. s. Adirondack .....	J. Sanson.	Fr. s. s. La Champagne .....	Boyer.	Br. s. s. Venice .....	A. B. Bolt.
Br. Adriatic .....	J. G. Cameron.	La Gascogne .....	Santelli.	Swed. Victoria .....	J. A. Kinnman.
Br. Aguan .....	J. C. Adair.	Lahn .....	H. Helmers.	Belg. Waesland .....	H. Buschmann.
Am. Alisa .....	J. W. Morris.	Lake Huron .....	M. L. Traunmar.	Westernland .....	J. C. Jamison.
Br. Alamo .....	Samuel Risk.	Lake Ontario .....	H. Campbell.	Br. Wetherby .....	S. Harrison.
Ger. Alene .....	E. J. Seiders.	Lake Superior .....	W. Stewart.	Ger. Wieland .....	H. Barends.
Br. Aller .....	H. Christoffers.	Lake Winnipeg .....	P. D. Murray.	William Cliff .....	E. Winder.
Br. Alvena .....	F. McKay.	Lampassas .....	M. B. Crowell.	Br. Wisconsin .....	J. P. Worral.
Alvo .....	D. Williams.	La Normandie .....	G. de Kersabiec.	Wyoming .....	C. L. Rigby.
Ger. Ambrose .....	E. Bisson.	Leerdam .....	G. Stenger.	Belg. Zeeland .....	E. Bence.
Br. America .....	H. Heintz.	Lero .....	J. Chisholm.	United States Naval.	
Am. Amsterdam .....	A. Potjer.	Letimbro .....	M. di Marco.	U. S. C. S. Blake .....	J. E. Pillsbury.
Br. Arizona .....	S. Brooks.	Llandaff City .....	T. H. Gore.	U. S. S. Despatch .....	W. S. Cowles.
Aurania .....	W. H. P. Hains.	Lord Clive .....	P. Uquhart.	U. S. S. Enterprise .....	B. H. McCalla.
Austerlitz .....	J. D. Fraser.	Lord Gough .....	E. M. Hughes.	U. S. R. S. Franklin .....	B. S. Richards.
Baltimore .....	J. Treney.	Lord O'Neill .....	A. Ferris.	U. S. R. S. Independence .....	J. W. Philip.
Barracouta .....	H. Hubbard.	Louisiana .....	E. V. Gager.	U. S. S. Juniata .....	W. C. Wise.
Barrowmore .....	J. Inch.	Lydian Monarch .....	T. C. Huggett.	U. S. S. Lancaster .....	T. F. Kane.
Br. Bavarian .....	M. Pitt.	Maine .....	M. Moller.	U. S. S. Michigan .....	H. F. Pickling.
Berrita .....	L. Santanari.	Mane .....	R. Griffiths.	U. S. S. Minnesota .....	G. C. Witte.
Bessarabia .....	J. Martin.	Manhattan .....	F. Stevens.	U. S. S. New Hampshire .....	J. F. Higginson.
Borderer .....	F. Manley.	Manitoba .....	W. Dunlop.	U. S. S. Wabash .....	C. C. Carpenter.
Br. Bracadale .....	J. Notman.	Maritana .....	G. Saville.	New York Herald reports.	
Britannic .....	H. Parsell.	Martello .....	W. Abbott.	Am. s. s. Algiers .....	E. J. Seiders.
British King .....	John Kelly.	Maryland .....	A. H. Luckhurst.	Br. Anchoria .....	W. Brown.
British Prince .....	S. Nowell.	Michigan .....	S. Walters.	Athos .....	H. Low.
British Princess .....	E. H. Freeth.	Minicola .....	T. L. Evans.	City of Chicago .....	A. Redford.
Brooklyn City .....	W. Pitt.	Minnesota .....	R. J. Blacklin.	Croma .....	W. R. Lord.
Ger. Buenos Ayres .....	K. Lowe.	Minia .....	S. Trott.	Devonia .....	J. Craig.
Br. Buffalo .....	J. H. Malet.	Moravia .....	Bahrends.	Am. pilot E. C. Knight .....	J. F. Springer.
Br. Bulgarian .....	R. Leask.	Muriel .....	G. S. Locke.	s. s. El Monte .....	J. W. Hawthorne.
Fr. Burgundia .....	F. Dulac.	Nederland .....	C. H. Grant.	Br. England .....	A. F. Heeley.
Br. Canada .....	J. Robinson.	Nesmore .....	G. Elliott.	Ger. Gellert .....	C. Hebieh.
Camellia .....	E. Penney.	Nevada .....	Cushing.	Fr. La Bretagne .....	M. de Jousselin.
Caribbean .....	H. Daniel.	Newham .....	J. J. Johnston.	Am. New Orleans .....	T. P. C. Halsey.
Carthaginian .....	A. McNicol.	Noordland .....	H. E. Nickels.	Rio Grande .....	J. F. Lewis.
Catalonia .....	J. J. Atkin.	Norrone .....	J. J. Isakjen.	Sailing vessels.	
Celtic .....	H. Davison.	Norseman .....	R. Williams.	Br. bk. Abyssinia .....	B. R. Hilton.
Am. Chalmette .....	G. W. Mason.	Nueces .....	J. Bolger.	Ger. bk. Albatross .....	C. Hannes.
Fr. Chateau Lafite .....	M. C. Ollivier.	Ohio .....	R. W. Sargent.	Am. bk. Albemarle .....	W. H. Forbes.
Am. Cherokee .....	B. F. Doane.	Oranmore .....	B. Jones.	bk. Alice .....	W. G. Kair.
Br. Circassia .....	H. Young.	Oregon .....	H. C. Williams.	Rus. Anso .....	C. Holstrom.
Circassian .....	K. Barrett.	Orinoco .....	J. S. Garvin.	Br. Atossa .....	E. Robinson.
Circe .....	A. T. Crighton.	Palestine .....	W. Whiteway.	Ger. Charlotte & Anna .....	Emil Kruger.
City of Alexandria .....	J. Deaken.	Para .....	J. Brander.	China .....	T. Selberg.
City of Augusta .....	J. W. Catherine.	Pavonia .....	A. McKay.	Am. bkt. C. S. Bushnell .....	A. R. Lente.
City of Berlin .....	A. W. Lewis.	Peland .....	G. Lutz.	sp. Cyrus Wakefield .....	I. N. Hibberd.
City of Chester .....	R. Bond.	Peconic .....	G. Evans.	bg. Daisy Boynton .....	C. Harding.
City of Newcastle .....	R. Townsend.	Pennland .....	Rud. Weyer.	Edith .....	W. G. Foster.
City of Para .....	E. L. Lockwood.	Pennsylvania .....	E. B. Thomas.	schr. Emma C. Knowles .....	A. W. Mayhew.
City of Washington .....	J. W. Reynolds.	Picqua .....	W. H. Brown.	Aust. bk. Errante .....	A. G. Nicolich.
Claribel .....	I. Clinkscl.	Polaria .....	G. Schmidt.	Am. schr. E. V. Danenhower .....	Eli Johnson.
Colon .....	F. Henderson.	Prinz William I. .....	H. N. Prins.	sp. George R. Skolfield .....	C. S. Dunning.
Corean .....	C. J. Menzies.	Prussian .....	J. Ambury.	schr. Gertrude .....	R. H. Cox.
Cuban .....	E. S. Winspeare.	Queen .....	J. Annison.	Harry Prescott .....	W. A. Turner.
Denmark .....	R. S. Rigby.	Rhaetia .....	H. Vogelgesang.	bk. Havana .....	B. F. Rice.
Discoverer .....	J. Hughes.	Rhyland .....	A. J. Griffin.	bg. H. B. Hussey .....	G. W. Hodgdon.
Donna .....	W. Topser.	Robins .....	T. H. Smith.	bkt. Henry Warner .....	J. T. Paine.
Br. Earnwell .....	C. N. Mumford.	Roman .....	E. Maddox.	sp. Herl of Herlofsen .....	J. B. Kroger.
Egypt .....	J. Sumner.	Rosarian .....	D. M. Killop.	Am. bk. L. Skolfield .....	G. L. Skolfield.
Egyptian Monarch .....	R. J. W. Bristow.	Rosse .....	T. Henning.	Br. Iodine .....	Adam Smith.
Elbe .....	R. Sander.	Roseville .....	J. Dove.	Am. yacht Iroquois .....	F. E. Norton.
Elmfield .....	T. Turbing.	Roxburgh Castle .....	A. Turpin.	Br. bk. Jennie Parker .....	G. F. Parker.
El Paso .....	H. S. Quick.	Rugia .....	R. Karlows.	Nor. Johannes Rod .....	Giersten.
Ems .....	T. Jungst.	Saale .....	H. Richter.	Am. schr. John A. Matheson .....	W. K. Matheson.
Erin .....	W. Tynon.	Saint Asaph .....	C. N. Hossock.	John J. Hanson .....	J. H. Stephens.
Ethiopia .....	J. Wilson.	Saint Romans .....	H. Campbell.	John R. Bergen .....	W. H. Squires.
Etruria .....	H. Walker.	Sailer .....	C. Thalenhorst.	bk. John R. Stanhope .....	J. B. Norton.
Euakaro .....	A. de Fellerio.	Santiago .....	J. B. Allen.	bkt. Jose E. More .....	Asmus Leonhard.
Br. Exeter City .....	T. L. Weiss.	Sarnia .....	J. Gibson.	Josephine .....	C. Brown.
Am. Excelsior .....	H. L. Higgins.	Saturnia .....	F. de Bengoa.	pilot Joseph F. Loubat .....	J. McCarthy.
Br. Explorer .....	E. A. Brown.	Scandinavian .....	J. Park.	bk. Kennard .....	J. A. Bettencourt.
Faraday .....	P. le Fanu.	Servia .....	H. McKay.	schr. Kensett .....	J. A. Smith.
Span. Federico .....	L. de Luzarraga.	Siberian .....	R. P. Moore.	Ger. bk. Kepler .....	H. Oetken.
Br. Foscolia .....	E. le Templier.	Slavonia .....	H. Schmidt.	Am. sp. Light vessel No. 45 .....	Andrew Jackson.
France .....	A. D. Hadley.	Spain .....	W. A. Griffiths.	Louis Walsh .....	T. C. Pendleton.
Ger. Fulda .....	R. Ringk.	State of Georgia .....	G. Moodie.	bk. Mary Pink .....	D. B. Darrah.
Span. Gadtano .....	F. Goicochea.	State of Indiana .....	A. Ritchie.	bkt. Monsita .....	E. E. Wallace.
Br. Gaelic .....	W. R. Pearne.	State of Nebraska .....	A. G. Bracs.	tern. Nantasket .....	F. M. Wallace.
Galileo .....	W. Magee.	State of Nevada .....	J. A. Stewart.	schr. Navarino .....	E. A. Richardson.
Germanic .....	P. J. Irving.	State of Pennsylvania .....	A. J. A. Mann.	bk. Neptune .....	J. W. Cole.
Glendower .....	J. A. Hodge.	State of Texas .....	G. Williams.	Nor. Orion .....	J. F. Hill.
Godfrey .....	J. C. Brown.	Stockholm City .....	W. Thompson.	Am. schr. Orlando .....	A. Matheson.
Gothenburg City .....	J. Harrison.	Strabo .....	A. Matheson.	bk. Otello .....	Charles Knebel.
Governor .....	J. Valiant.	Suevia .....	C. Ludwig.	Ger. bk. Phibe .....	M. J. Bond.
Greece .....	A. J. Jeffrey.	Switzerland .....	J. Uebirweg.	bk. Philat .....	M. Medero.
Gussie .....	R. Staples.	Taormina .....	G. W. Koch.	Rus. sp. Primers .....	G. Gerlach.
Br. Guyandotte .....	R. B. Boss.	Thammore .....	C. W. Simpson.	Dan. bk. Rialto .....	Oscar Heins.
Haytien .....	J. Goward.	The Queen .....	G. T. Griffin.	Nor. Rimalce .....	L. F. Jorgenson.
Br. Helka .....	A. G. Thomson.	Thingvalla .....	Larsen.	Br. bg. R. L. Y .....	E. Solveson.
Dan. Helvetia .....	G. Cochran.	Thomas Brooks .....	E. F. Canal.	bk. Salina .....	W. Thompson.
Holland .....	T. Foote.	Toronto .....	J. MacAuley.	Sapphire .....	J. Peterson.
Am. Hudson .....	H. R. Freeman.	Tower Hill .....	R. Bennett.	Am. Sarah A. Staples .....	G. W. Murray.
Br. Iowa .....	E. W. Owens.	Trave .....	W. Willigerod.	sp. Tillie E. Starbuck .....	H. N. Gay.
Dan. Island .....	W. Skjott.	Trinidad .....	W. J. Fraser.	bk. Tremont .....	E. Curtis.
Br. Istrien .....	A. W. Ball.	Umbria .....	J. Barber.	Br. Veritas .....	Brophy.
Italy .....	W. Pearce.	Vandek .....	W. McMickan.	William Cochran .....	J. W. McCully.
Am. King's Cross .....	G. J. Mills.	Vandam .....	F. P. Fisher.		H. W. Derrier.
Fr. Knickerbocker .....	F. Kemble.	Venetian .....	F. H. Bonjer.		
La Bourgogne .....	E. Franguel.		E. Parry.		



# UNITED STATES SIGNAL SERVICE

## MONTHLY WEATHER REVIEW.

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### INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for February, 1889, and is based upon reports of regular and voluntary observers of both countries.

On chart i the paths of the centres of nine areas of low pressure are shown; the average number traced for February during the last fourteen years being 10.7. This chart also exhibits the approximate paths of the centres of seven depressions traced over the north Atlantic Ocean; the limits of fog-belts west of the fortieth meridian, and the distribution of field ice during the month. The areas of high and low pressure and north Atlantic storms are discussed under their respective headings.

Chart ii exhibits the distribution of mean atmospheric pressure and temperature for the month. The mean temperature was above the normal from the upper Missouri valley westward to the Pacific coast, and thence southward over California; it was also slightly above the normal in eastern Nova Scotia. The greatest excesses occurred in, and north of, Dakota, northern Montana, and in northwestern Washington, where the means were 5°, or more, above the normal. In all other districts the month was cooler than the average February, the most notable deficiencies occurring east of the Mississippi River, and from the southern part of the Lake region to the Gulf of Mexico, where they exceeded 5°.

The distribution of precipitation for February, 1889, is shown on chart iii, and the normal precipitation for eighteen years is exhibited on chart iv.

The precipitation was deficient in the plateau and Pacific coast regions, and in all districts east of the Mississippi River, except in the upper lake region and the south Atlantic states, where there was a slight excess. On the eastern Rocky Mountain slope, in the extreme northwest, and the Missouri and Rio Grande valleys the precipitation was in excess of the average for the month. The current and normal precipitation in the several districts is treated in detail under the heading

"Precipitation." In the table of excessive precipitation a record of excessive monthly, daily, and hourly rainfalls for February, 1889, will be found. In this issue of the REVIEW there also appears a summary, by stations, of excessive monthly, daily, and hourly rainfalls at regular stations of the Signal Service during the periods of observation.

Chart v exhibits the depth of snow on the ground at the close of the month, and its discussion appears under the heading of "Precipitation." This chart also shows the limits of freezing weather during February, 1889.

Commencing with July, 1888, the meteorological means for the regular stations of the Signal Service have been determined from observations taken twice daily at 8 a. m. and 8 p. m. (75th meridian time). These hours of observation have been permanently adopted to supersede the former system of tri-daily observations taken at eight-hour intervals. The monthly mean temperature for Signal Service stations represents the mean of the maximum and minimum temperatures.

In the preparation of this REVIEW the following data, received up to March 20, 1889, have been used: the regular semi-daily weather-charts, containing data of simultaneous observations taken at 133 Signal Service stations and 24 Canadian stations, as telegraphed to this office; 171 monthly journals and 175 monthly means from the former and 24 monthly means from the latter; 557 monthly registers from voluntary observers; 109 monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the Hydrographic Office, United States Navy, and the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New England, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, and Texas, and the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

### ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for February, 1889, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on chart ii by isobars. On July 1, 1888, the tri-daily observations of the Signal Service were superseded by observations taken twice daily at the hours named. A protracted series of hourly observations has shown that the difference is almost inappreciable between the mean pressure obtained from two observations taken at these hours and that determined from tri-daily observations taken at eight-hour intervals.

The mean pressure for February, 1889, was highest at stations in the middle and northern plateau regions of the Rocky Mountains, where it rose above 30.25. Within an area extending from the south Atlantic and east Gulf states north-

westward to the upper valley of the Columbia River the mean values were above 30.20. The mean pressure was lowest over the northern portion of New Brunswick, where it fell to 29.99 at Father Point. Over the western portion of the country the mean readings were above 30.10, except in southern California and portions of southern Arizona and New Mexico.

As compared with the pressure chart for January, 1889, a general increase in pressure is shown, except over the middle Rocky Mountain regions and in south-central New Mexico, where there has been a slight decrease. The most marked increase has occurred from the Mississippi and lower Missouri valleys eastward to New England and the Atlantic coast states, where the mean readings in February were from .10 to .14 higher than in the preceding month. Along the Pacific coast

the increase varied from .10 at the mouth of the Columbia River to .01 in the upper valley of the San Joaquin River. No material changes occurred in the positions of the areas of highest and lowest mean pressure.

As compared with the normal pressure for February the mean pressure was above the normal, except in southern and southwestern California, southern New Mexico, and in the Saint Lawrence Valley, where slight deficiencies were shown, the most marked of which, .06, was noted at San Diego, Cal. At Yarmouth, N. S., and Norfolk, Va., the mean pressure was normal. The greatest departures above the normal occurred in northern Washington, where, at stations, they were more than .15. Over the central portions of the country east of the Rocky Mountains the February, 1889, means averaged about .05 above the normal.

#### BAROMETRIC RANGES.

The monthly barometric ranges at the several Signal Service stations are given in the table of miscellaneous meteorological data. The general rule, to which the monthly barometric ranges over the United States are found to conform, is that they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. In the current month the ranges were greatest in southeastern Minnesota, where they exceeded 1.60, whence they decreased to upper Michigan, where they were less than 1.20. From the upper lake region the barometric ranges increased eastward to New England, where they amounted to more than 1.60 in southern New Hampshire. From Minnesota westward the ranges decreased to less than .30 in the northern plateau region of the Rocky Mountains. Along the Atlantic coast the ranges varied from .36 at Key West, Fla., to 1.61 at Manchester, N. H.; between the eighty-second and ninety-second meridians, .61 at Cedar Keys, Fla., to 1.58 at La Crosse, Wis.; between the Mississippi River and the Rocky Mountains, .72 at Galveston and Brownsville, Tex., to 1.70 at Saint Paul, Minn.; in the plateau and Rocky Mountain regions, .58 at Fort Grant, Ariz., to 1.30 at Poplar River, Mont.; on the Pacific coast, .52 at San Diego, Cal., to .85 at Roseburg, Oregon.

#### AREAS OF HIGH PRESSURE.

In the study of areas of high pressure which were observed during the month of February it will be observed that during the first half of the month an area of high pressure covered the northern and central plateau regions, remaining almost stationary, but at times the centre oscillated between Utah and Oregon. While the pressure at the centre varied, it continued decidedly above the normal until the development of the storm in the Rocky Mountain region on the 13th. Seven areas of high pressure were observed during the month, five of which approached the stations from British America, and these, with one exception reached the Atlantic coast. The direction of movement while near the centre of the continent was more directly south than usual, but after approaching the coast the movement changed to easterly. The four areas which left the coast north of Hatteras, N. C., apparently inclined to the north of east after reaching the coast line.

I.—This area of high pressure was a continuation of number vi described in the January REVIEW. On the 1st of the month it extended over the plateau and Pacific coast regions from British America to Mexico, the pressure at the centre being 30.64. This distribution of pressure continued until the 13th, the maximum pressure occurring on the 2d, after which the barometer oscillated (but remained high) during the transit of two areas of high pressure over the eastern slope of the Rocky Mountains, one of which was apparently formed from the cold air passing eastward over the Rocky Mountains from this area, and the other moving southward from British America, with considerable energy, apparently caused a decline of barometric pressure over the plateau regions.

II.—This area of high pressure appeared north of Manitoba on the 4th, while there was a severe storm central in the Lake region, and moved directly southward to the Missouri Valley,

preceded by general snow and attended by a decided cold wave; the temperature falling to  $-46^{\circ}$  north of Minnesota on the 5th, and freezing weather occurred along the east Gulf coast and in Florida on the 7th. After the centre reached the lower Missouri valley it passed southeastward over Tennessee and northern Alabama and Georgia, and disappeared off the south Atlantic coast during the 8th. While the cold wave reached the east Gulf coast and northeastern Texas, it did not extend to Galveston and southern Texas, the movement of the high area being such as to cause easterly winds in the west Gulf, thereby reducing the effect of the cold wave. This cold wave may be cited as an illustration of the statement previously made by this office, that the appearance of a cold wave in Minnesota and Dakota is not invariably followed by a cold wave on the Texas coast. In this case the temperature at Bismarck, Dak., fell from  $38^{\circ}$  on the 3d to  $-6^{\circ}$  on the morning of the 5th, a fall of  $44^{\circ}$ ; and the cold wave caused a fall of  $20^{\circ}$  at New Orleans, La., attended by freezing weather, while the temperature remained at about  $50^{\circ}$  at Galveston, Tex.

III.—This area formed on the eastern slope of the Rocky Mountains on the 8th, and was apparently a part of the high area previously noted as central in the plateau regions. It moved eastward over the Southern States during the 9th and 10th, inclining slightly to the north of east as it approached the Atlantic coast, while the pressure at the centre decreased slowly after the area passed the Mississippi Valley. It disappeared east of the middle Atlantic coast during the 10th, and the increase of pressure during the night of the 11th at stations in Nova Scotia indicated a northeasterly movement over the Atlantic.

IV.—Number iv was first observed on the 14th north of the upper lake region, to the west of a severe storm in the Maritime Provinces and to the northeast of an extended low area then covering the Rocky Mountain region. It passed southeastward from the Hudson Bay region over the Saint Lawrence Valley and New England, attended by a cold wave in the upper Saint Lawrence valley and no marked change in temperature along the coast. The pressure at the centre decreased during the southeasterly movement, and it disappeared to the east of Nova Scotia on the 16th.

V.—Number v appeared on the 15th far to the north of Montana and extended southward over the eastern Rocky Mountain slope during the 16th and 17th, causing on the latter date a decided fall in temperature as far south as northern Texas. The movement of the centre of greatest pressure was first apparently to the eastward, and after reaching Manitoba it changed to the southward, disappearing while central over the Indian Territory on the 18th. This area of high pressure was followed quickly by high area number vi, of which it formed a part after the 18th.

VI.—Number vi was observed north of Montana on the 19th, and was apparently a reinforcement of the area previously described. The centre of greatest pressure was transferred from the Indian Territory to north of Dakota between the 18th and 19th, after which the movement was rapid to the southeast, attended by decidedly cold weather throughout the Northwest, Lake region, and central valleys. The centre passed to the lower Ohio valley on the 20th, when this area covered the greater portion of the country east of the Rocky Mountains, after which it moved eastward to the middle Atlantic coast, attended by increasing pressure at the centre. After reaching the coast line it apparently moved to the northeastward, and it was last observed over the Atlantic southeast of Nova Scotia on the 22d.

VII.—When the preceding area covered the eastern portion of the United States number vii appeared to the north of Idaho, apparently moving southward. It extended over the eastern slope of the Rocky Mountains and central valleys during the 22d and 23d, attended by the most intense and extended cold wave of the month. In the extreme northwest the temperature fell to  $-52^{\circ}$ , and the barometric pressure reached the unusual reading of 31.16. On the 23d the temperature ranged



from  $-10^{\circ}$  to  $-20^{\circ}$  in the upper lake region, while it was from  $-20^{\circ}$  to  $-40^{\circ}$  in Minnesota and Dakota. During the passage of this cold wave over the Lake region the minimum temperatures of the season occurred in the northern states east of the Mississippi and as far southward as Tennessee and North Carolina. During the twenty-four hours following the 8 a. m. report of the 23d the centre of greatest pressure passed from Manitoba to the middle Atlantic states, the barometer falling from 31.10 to 30.88 during the transit. The easterly movement continued during the 24th, the pressure increasing at Sydney from 30.22 on the night of the 23d to 30.86 on the morning of the 25th. A secondary area of high pressure (viii) formed over the Lake region on the 25th, and moved northeastward over the Saint Lawrence Valley, where it continued until the morning of the 28th, but during the last twelve hours of the month the centre of greatest pressure passed southwestward to the middle Atlantic states.

The following table exhibits, in a concise manner, some of the more prominent characteristics of the high areas:

No.	First observed.			Last observed.		Duration.	Velocity per h'r.	Highest pressure.		
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.			Date.	Station.	Reading.
		°	°	°	°	Days.	Miles.			Fathes.
I.....	1	42	115	37	112	12.0	*	2	Salt Lake City, Utah.....	30.76
II.....	4	55	97	31	78	3.5	28.0	5	Minnedosa, Manitoba...	30.66
III.....	8	38	100	37	81	1.5	33.3	9	Fort Smith, Ark.....	30.42
IV.....	14	52	82	43	62	2.0	27.1	15	Rockliffe, Ont.....	30.52
V.....	15	53	116	36	98	3.0	26.4	16	Qu'Appelle and Swift Current, N. W. Ter.	30.52
VI.....	19	50	103	42	60	3.0	40.3	21	New York City.....	30.76
VII.....	20	52	117	44	59	4.5	29.7	22	Qu'Appelle, N. W. Ter.	31.16
VIII.....	25	44	79	48	63	3.0	13.9	26	Bird Rocks, Gulf of St. L.	30.92
Means	.....	.....	.....	.....	.....	4.1	24.8	.....	.....	30.76

\* Nearly stationary.

#### AREAS OF LOW PRESSURE.

During the month of February that portion of the country southward of the Lake region was comparatively free from barometric disturbances of marked intensity. Of the nine areas of low pressure traced on chart i it will be noted that six were observed in British America north of Montana and Dakota, from which region they all moved in the direction of the Great Lakes, inclining first to the south of east, and afterwards following the general course of the Saint Lawrence Valley. One area of low pressure was observed in the region of the Gulf of Mexico, and one, which developed in the central Rocky Mountain region, after being forced southward to Texas passed northeastward to the Lake region.

The following table exhibits the principal facts regarding these low areas:

No.	First observed.			Last observed.		Duration.	Velocity per h'r.	Lowest pressure.		
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.			Date.	Station.	Reading.
						Days.	Miles.			Inches.
I.....	29*	52	100	48	57	3.0	29.9	1	Halifax and Sydney, N. S	29.20
II.....	1	52	96	42	80	1.5	25.0	2	Saugeen, Ont.....	29.56
III.....	3	50	104	48	57	3.0	31.9	6	Father Point, Quebec..	29.08
IV.....	6	52	100	47	61	2.0	33.3	9	Sydney, N. S.....	29.60
V.....	9	49	100	47	77	2.0	29.2	11	Saugeen, Ont.....	29.50
VI.....	12	53	110	47	95	1.0	37.5	12	Qu'Appelle, N. W. T....	29.50
VIIa.....	13	40	104	32	87	4.5	25.0	13	Denver, Colo.....	29.32
VII.....	17	29	97	49	64	2.0	50.0	19	Anticosti, Gulf of St. L.	29.16
VIII.....	20	48	109	52	62	2.0	50.0	23	Anticosti, Gulf of St. L.	29.72
IX.....	27	54	115	53	96	1.0	37.5	27	Swift Current, N. W. T.	29.68
Means.....						2.3	34.9			29.43

\* January. † Also at Sault de Ste. Marie, Mich., on the 16th.

I.—This storm was partially described in the January REVIEW. The month of February opened with the centre of disturbance in Maine, north of Portland, with a well-marked barometric gradient to the west and southwest, and westerly gales on the Atlantic coast as far south as Hatteras, N. C.

The storm moved eastward to Nova Scotia during the 1st, causing severe gales in the Maritime Provinces, which continued during the 2d, the centre of disturbance passing to the northeast after reaching the Nova Scotia coast.

II.—This storm had also appeared within the limits of observation by the first telegraphic report of the month. When the preceding storm was central over Maine, this disturbance was approaching from British America and was central north of Manitoba. It passed southeastward north of the upper lake region, causing fresh to brisk westerly winds, but becoming more extended and apparently losing energy during the easterly movement. It could not be traced farther east than the lower lake region, but a secondary disturbance developed off the New England coast on the 3d and apparently moved northeastward over the Atlantic.

III.—This storm was also first observed north of Montana, where it was central on the afternoon of the 3d. It increased rapidly in energy and moved at the rate of about sixty miles per hour during the night of the 3d, the morning report of the 4th exhibiting a well-defined area of low pressure, bounded by circular isobars, central near Saint Paul, Minn., where the barometer had fallen from 29.82 to 29.18 in twelve hours. Within the west quadrants of this storm, at stations in the upper Missouri valley and at northern Rocky Mountain stations, wind velocities ranged from forty to sixty-six miles per hour, and were in many cases accompanied by light snow. During the easterly movement of this storm the snow increased, and gales continued in the Lake region and upper Mississippi valley. The centre of disturbance reached its most southerly latitude while passing over Michigan, from which point it moved northeastward to New England and thence almost directly northward to the Saint Lawrence Valley. This storm was one of marked energy throughout its entire course, the pressure at the centre falling to 29.18 in the Northwest, and then increasing to about 29.30 while passing eastward to the New England coast, after which a second fall in the barometer occurred when the minimum pressure was observed.

IV.—Number iv was observed north of Dakota on the 6th, when the preceding storm was central in the lower Saint Lawrence valley. It moved over the same general course followed by the preceding storm, moving first southward to southern Minnesota and thence eastward over the Lake region and New England, disappearing to the north of Nova Scotia on the 9th. It was a disturbance of slight energy, and, although clearly defined, the pressure at the centre remained near 29.80 during its transit, although it fell to 29.60 at Sydney, N. S., when the centre was near that station.

V.—Number v was first observed in the region north of Dakota on the 9th, and followed the same general course as that described for the two preceding storms, except that after reaching the longitude of Lake Huron its track was to the north of the Saint Lawrence River. It developed but slight energy until reaching the upper lake region, when it became well defined as a barometric disturbance attended by winds of moderate force. The pressure at the centre reached its minimum while passing over Lake Huron, after which the isobars bounding the storm became more extended, and the location of the centre could not be determined after the 11th. Reports from the Atlantic coast indicate that a storm passed northeastward off the middle Atlantic and New England coasts, following the general course of the Gulf Stream, about the time of the disappearance of this storm in the Lake region.

VI and VIa.—The morning reports of the 12th indicated the advance of an area of low pressure from the region north of Montana, while an area of high pressure covered the plateau and Rocky Mountain regions, extending from Washington Territory to Texas and the lower Mississippi valley. During the succeeding twenty-four hours the area of low pressure moved southeastward, covering the eastern slope of the Rocky Mountains, the centre of disturbance being in Minnesota, while a secondary depression (via) covered eastern Colorado. During the 13th the low area in Minnesota disappeared by an increase

of pressure, apparently due to the advance of an area of high pressure from the north, while from the same cause the disturbance in Colorado was forced southward to New Mexico, and apparently divided—one portion passing over Texas and developing energy which resulted in the general storm traced as *vi a*. It passed from Texas northeastward over the Lake region from the 15th to 17th, attended by general rains in all districts east of the Mississippi and by snows in the Northwest. The rains attending this storm were heavy in the Ohio Valley and middle Atlantic and Southern States, and damaging floods occurred in the rivers of South Carolina. This storm moved at the rate of about sixty miles per hour during the first twelve hours of its northeasterly movement from northern Texas to northern Illinois. Its movement was somewhat retarded while passing over the upper lake region, and its direction was deflected toward the north. After passing the upper lake region the northeasterly movement was resumed. That portion of the low area which was apparently forced westward over New Mexico and Utah remained about stationary during the 15th and 16th, and finally disappeared by a gradual increase of pressure without causing any marked disturbance.

VII.—Number vii developed in southern Texas on the 17th, when the pressure was low over the Rio Grande Valley and New Mexico and an area of high pressure covered the northern portion of the eastern Rocky Mountain slope. It passed rapidly to the northeast, moving at the rate of seventy-five miles per hour during the night of the 17th, the centre of disturbance

passing from southern Mississippi to western Pennsylvania, the barometer at the centre falling from 29.68 to 29.36 during this interval. This rapid movement was apparently due to the southerly movement of the area of high pressure and attending cold wave to the westward, which caused a "norther" in the Southwest and a cold wave over the central valleys. The northeasterly movement continued during the 18th and 19th, and the depression disappeared to the northeast of New England on the latter date, but the westerly gales continued on the north Atlantic coast until the 20th.

VIII.—Number viii developed in northern Montana on the 20th and passed rapidly eastward over Dakota, Minnesota, and the upper lake region, preceded by fair weather and warm southerly winds and followed by general snows and the most decided cold wave of the month. Although the pressure at the centre of this disturbance remained near 29.90 during its passage over the continent, the barometric gradient to the westward was well marked, owing to the unusually high barometric readings within the high area to the westward. The rapid easterly movement continued after passing the Lake region, and it disappeared on the 23d to the east of Nova Scotia.

IX.—Number ix appeared far to the north of Montana on the 27th, although the pressure was low in that region during the 26th, and also on the north Pacific coast on the 25th. It passed eastward as far as Manitoba, where it was central at the close of the month, but the pressure had increased at the centre during the easterly movement.

#### NORTH ATLANTIC STORMS FOR FEBRUARY, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during February, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Seven depressions have been traced for February, 1889, of which five advanced over or near Newfoundland; one apparently developed south of Nova Scotia, and one first appeared southwest of the British Isles. The approximated paths of two depressions of great strength which appeared between the Azores and the West Indies in the latter part of January, 1889, are also shown on this chart.

Over the western portion of the ocean the weather during February, 1889, continued generally unsettled, with gales of varying force, until the 23d, after which fair weather predominated, until the close of the month. Over mid-ocean the stormy periods were the 9th, 13th to 17th, 21st and 22d, the remainder of the month being characterized by unusually fine weather and generally high barometric pressure. Over and near the British Isles the storm periods extended from the 1st to 3d, 8th to 11th, 13th to 16th, and 26th to 28th, the severest storms occurring during the first decade of the month.

As compared with the corresponding month of previous years, the storms of the north Atlantic during February, 1889, were deficient in number and energy, more particularly over mid-ocean. Barometric pressure falling below 29.00 (737) was reported on but two dates, on the 3d over the northern portion of the British Isles, and on the 12th to the southward of Nova Scotia, while in preceding years correspondingly low pressure has been more frequently noted in February.

The following extract from a report by Captain Brillonin, of the French s. s. "Ville de Bordeaux," indicates the severe character of the disturbances which attended the depression traced between the West Indies and the Azores from the 26th to the 28th, inclusive: "26th, noon, position by dead reckoning, N. 25° 27', W. 54° 18'; sea growing higher and higher; barometer fell to 29.69 (754); the wind, from e. by s., in violent squalls alternated with calms all the afternoon; sea always

growing worse; 9.30 p. m., barometer 29.49 (749); midnight, blowing a hurricane; barometer 29.33 (745), after which it rose gradually. 27th, 4 a. m., barometer 29.41 (747); sea frightful from e. to ne. and n.; squalls of great violence from e. Wind backed to ne., nne., and n. during the 27th, and the barometer continued to rise."

The following abstract from the log of the s. s. "Hungarian," Capt. A. Langlois, commanding, shows the general character of the storms which attended the depression whose approximated path is charted southwest of the Azores on January 26th and 27th: "25th, fresh se. wind and very hard squalls of wind and rain; sea very much confused from se. and westward; noon, in N. 33°, W. 40°, wind very unsteady in force from n.; 3 p. m., hard squalls from nw.; 4 p. m., fresh gale from nw.; barometer stopped falling at 29.38 (746); midnight, hard gale and very heavy sea. 26th, 1 a. m., furious gale and terrific sea, sweeping clear over the ship; noon, in N. 31°, W. 42°, moderating a little; wind backing to westward and rather less sea."

The following are brief descriptions of the depressions traced during February, 1889:

1.—This depression was a continuation of low area i, and on the 2d was central over the east portion of the Gulf of Saint Lawrence, with pressure falling below 29.30 (744) and fresh to strong gales to the thirtieth parallel. By the 3d the storm-centre had passed to the northward of Newfoundland beyond the region of observation.

2.—This depression apparently developed northwest of Bermuda on the 3d, and thence moved northeast to the forty-first parallel by the 4th, whence it probably passed northward over Newfoundland, its course being attended throughout by gales of moderate strength.

3.—This depression was a continuation of low area iii, which caused severe gales off the middle Atlantic and New England coasts during the 6th and 7th, and by the morning of the 7th had advanced over the Gulf of Saint Lawrence. Moving north of east the depression was central north of the Banks of Newfoundland on the 8th, and thence moved north of east to the thirty-fourth meridian by the 9th, and at noon, Greenwich time, of the 10th, had apparently advanced to the north of



Ireland, where it displayed considerable energy and occasioned hard gales over and near the British Isles during that and the following date. During the 11th the centre of disturbance moved eastward over the North Sea.

4.—This depression apparently originated north of the Bahamas, and on the morning of the 11th was central off the North Carolina coast, with pressure below 29.70 (754) and moderate to fresh gales. By the 12th the centre of disturbance had moved northeast to the thirty-ninth parallel, attended by gales of hurricane force, and pressure falling below 29.00 (737). On this date the lowest barometer reading reported during the month, 28.32 (719), was noted by Captain Saville, of the s. s. "Lemuria," at noon, in N. 36° 50', W. 66° 58'. During the 13th the depression passed northeastward over Newfoundland, and thence advanced north of east and disappeared north of the British Isles after the 15th, its passage being attended by an apparent gradual decrease in energy.

5.—This depression was central over the Gulf of Saint Lawrence on the 14th, with central pressure below 29.40 (747). On the morning of the 15th the storm was central over Newfoundland, where pressure falling below 29.30 (744) was indicated, whence it moved north of east to the thirty-ninth meridian by the 16th, attended by fresh to whole gales. By the 17th the centre of depression had moved southeast to the forty-ninth parallel, after which it disappeared in the vicinity of the Azores. A marked loss of energy was evidenced on the part of this storm after the 16th.

6.—This depression was a continuation of low area vii which passed eastward over the Gulf of Saint Lawrence, with pressure below 29.30 (744). Advancing eastward to the thirtieth meridian by the 22d the storm-centre moved thence southeastward and disappeared northeast of the Azores, its course after the 20th being attended by gales of diminishing strength.

7.—This depression first appeared southwest of the British Isles on the 26th, where pressure falling to about 29.50 (749) and strong to whole gales were reported. By noon, Greenwich time, of the 27th the centre of depression had apparently moved eastward over the French coast.

#### OCEAN ICE IN FEBRUARY.

The following table shows the southern and eastern limits of the region within which icebergs or field-ice were reported for February during the last seven years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
February, 1883.....	42 01	52 46	February, 1883.....	46 19	45 44
February, 1884.....	42 00	50 00	February, 1884.....	46 50	43 45
February, 1885.....	41 50	51 12	February, 1885.....	47 52	42 00
February, 1886.....	46 10	47 15	February, 1886.....	45 00	44 47
February, 1887.....	40 00	48 00	February, 1887.....	46 26	41 50
February, 1888.....	44 59	45 08	February, 1888.....	44 59	45 08
February, 1889.....	45 35	48 00	February, 1889.....	45 35	48 00

From the above it will be seen that during February, 1889, ice was encountered about two and one-half degrees north and four degrees west of the average southern and eastern limits for the month, as determined from reports made during the preceding six years.

Field ice has been reported for February, 1889, as follows: 24th, s. s. "Mars," off the Banks, passed through small pieces of detached ice for thirty hours. Schr. "Herman Babion" (no date), eighty miles west one-half south of Saint Pierre, Miquelon, encountered heavy drift ice, which extended all the way to Scatari. Schr. "Cecil H. Low" (no date), twenty

miles southwest from Scatari, heavy field ice. Ship "William Cochran," in N. 45° 35', W. 48°, one piece of field ice fifty feet long, just awash.

No icebergs have been reported for February, 1889. This fact constitutes an unusual feature, as with the exception of the current and the preceding year, icebergs have been encountered over or near the Grand Banks in February since, and including, 1883. The field ice reported was also largely deficient, when compared with the average for the month.

#### FOG IN FEBRUARY.

The following are limits of fog-areas on the north Atlantic Ocean during February, 1889, as reported by shipmasters:

Date.	Entered.			Cleared.	Date.	Entered.			Cleared.
	Lat. N.	Lon. W.				Lat. N.	Lon. W.		
1	45 12	50 28	45 06	51 13	16-17	40 48	73 00	Sandy Hook.	
4	45 26	49 39	45 43	48 30	17	41 00	66 30	40 45	67 33
4	44 02	48 32	43 35	50 15	17	40 39	66 32	40 27	70 13
4-5	44 37	46 56	42 28	52 36	17	39 55	68 48	40 25	69 10
4-5	42 50	49 50	43 50	53 40	17-18	35 25	75 20	37 00	75 30
4-5	45 41	50 48	46 30	47 44	18	40 27	73 55	New York.	
6	43 11	53 24	43 27	52 33	18	40 28	70 15	40 40	71 00
6-7	42 50	60 30	42 30	63 30	18	41 40	53 30	41 22	64 20
7	45 15	43 35	45 36	42 38	18-19	44 35	55 30	43 36	56 30
7	42 39	52 36	42 50	50 20	18-19	42 51	50 55	42 40	53 59
7-8	48 06	43 35	45 55	49 05	19	46 08	57 12	45 35	56 16
12	43 19	48 41	42 55	49 59	19	43 45	54 34	43 37	55 56
13	45 20	51 07	45 20	53 30	19-20	46 57	45 04	47 36	42 09
13-14	42 45	49 07	42 54	48 35	19-20	45 30	47 30	44 50	51 09
15	32 06	80 32	32 06	80 35	20	44 27	51 37	45 14	54 12
16-17	35 35	75 20	NE. light-ship.		24	44 49	47 58	45 01	48 37
16-17	Galveston.		27 30	91 30					

The limits of fog-belts west of the fortieth meridian are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on thirteen days, as compared with five days for January, 1889, and seventeen days for February, 1888. Between the fifty-fifth and sixty-fifth meridians fog was reported on four days, as compared with ten days in January, 1889, and eight days in February, 1888. To the westward of the sixty-fifth meridian fog was reported on three days, as compared with five days in January, 1889, and eleven days in February, 1888. As compared with the preceding month a marked increase in fog frequency is shown near the Grand Banks, while to the westward of the fifty-fifth meridian there has been a decrease. The southern limit of fog has extended southward over the trans-Atlantic tracks east of the fifty-fifth meridian.

During the 16th and 17th dense fog was encountered in the Gulf of Mexico from Galveston, Tex., east-southeast to about W. 91° 30', with rain, s. to sse. winds, and fresh ssw. winds at times. On the 15th fog was reported off Savannah, Ga., with variable winds and rain. On the 1st, 4th, 12th to 14th, and 18th to 20th fog was reported over or near the Banks of Newfoundland, with south to east winds, occasioned by the approach or passage of areas of low pressure. From the 5th to 8th, inclusive, fog occurred in that region, attending the passage of an area of low pressure from over the middle Atlantic states to the north of Newfoundland, and on the 24th fog was noted, with fresh, variable winds. On the four dates for which fog was reported between the fifty-fifth and sixty-fifth meridians, areas of low pressure were located, respectively, over New England, the middle Atlantic states, and the Gulf of Saint Lawrence. Fog was reported off the Atlantic coast of the United States on the 16th, 17th, and 18th, with rain and variable winds. On the 18th a storm of considerable energy, which had advanced from the southwest, was central over the middle Atlantic states.

#### TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for February, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the

monthly mean temperatures and the departures from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the

columns for mean temperature show the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above.

The mean temperature was highest over southern Florida, where it rose to 69°.4 at Key West, and over the southern extremity of Louisiana, where a reading of 66°.7 was noted at Port Eads. Values above 55° were reported in Florida south of the twenty-ninth parallel, along the west Gulf coast, in the lower Rio Grande valley, over southern California, the southern extremity of Nevada, and southwestern Arizona. On the Pacific coast the means were above 50° south of the fortieth parallel and in, and west of, the Sacramento and San Joaquin valleys, while along the immediate coast north of the fortieth parallel they rose to or above 45°. The lowest mean temperature for the month occurred in Manitoba, where a reading of -5° was noted at Winnipeg. A line representing a mean temperature of zero is traced from western Manitoba south-eastward over the valley of the Red River of the North to Moorhead, Minn., and thence north of east to Port Arthur, Ont. Within a limited area in south-central Colorado values below 15° were reported. The mean temperature was below 32° north of a line traced from the Atlantic coast in about Lat. N. 37°, westward to the Mississippi Valley, and thence west-southwest to central New Mexico and central Arizona, and east of this line continued from central Arizona irregularly west of north over the plateau regions.

The mean temperature was generally below the normal in the middle and southern Rocky Mountain districts and over the entire eastern half of the country, except at stations in south-central and eastern Nova Scotia. It was above the normal from the upper Missouri valley westward over the northern Rocky Mountain districts to the Pacific coast, and thence southward over California. The most marked departures below the normal were noted east of the Mississippi River and from the southern portion of the Lake region southward to the Gulf of Mexico, where they exceeded 5°. The greatest excesses in temperature occurred at stations in Dakota, northern Montana, northwestern Washington, and the middle and upper Saskatchewan valley, where the means were 5° or more above the average for the month. In Nova Scotia the departures above the normal varied from 1° at Halifax, N. S., to 4° at Sydney, C. B. I.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

Above normal.		Below normal.	
Fort Assinaboine, Mont.....	8.8	Detroit, Mich.....	8.6
Olympia, Wash.....	5.6	Jacksonville, Fla.....	8.6
Fort Sully, Dak.....	5.0	Chicago, Ill.....	8.1
Portland, Oregon.....	4.2	Savannah, Ga.....	8.0
San Diego, Cal.....	4.0	Cincinnati, Ohio.....	7.7

#### DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for February, 1889; (4) the departure of the current month from the normal; (5) and the extreme monthly means for February during the period of observation and the years of occurrence:

State and Station.	County.	(1) Normal for the month of Feb.	(2) Length of record.	(3) Mean for Feb., 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for February.			
						Highest.	Year.	Lowest.	Year.
Arkansas.		°	Years	°	°	°		°	
Lead Hill.....	Boone.....	39.7	7	36.7	-3.0	49.9	1882	32.2	1885
California.									
Sacramento.....	Sacramento.....	50.5	33	44.9	-5.6	55.0	1877 79	43.7	1887

#### Deviations from normal temperatures—Continued.

State and Station.	County.	(1) Normal for the month of Feb.	(2) Length of record.	(3) Mean for Feb., 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for February.			
						Highest.	Year.	Lowest.	Year.
Colorado.		°	Years	°	°	°		°	
Fort Lyon.....	Bent.....	32.3	20	28.5	-3.8	39.1	1867	23.1	1883
Connecticut.									
Middletown.....	Middlesex.....	26.6	21	23.5	-3.1	34.5	1867	17.7	1885
Florida.									
Merritt's Island.....	Brevard.....	64.2	6	58.0	-6.2	69.4	1887	58.0	1889
Georgia.									
Forsyth.....	Monroe.....	51.8	15	48.0	-3.8	58.1	1883	44.5	1885
Illinois.									
Peoria.....	Peoria.....	29.3	33	26.0	-3.3	39.3	1882	15.5	1875
Riley.....	McHenry.....	22.3	33	15.7	-6.7	32.4	1882	4.7	1875
Indiana.									
Vevay.....	Switzerland.....	35.8	22	32.1	-3.7	45.5	1882	25.1	1885
Iowa.									
Cresco.....	Howard.....	15.5	17	11.0	-4.5	31.3	1878	1.0	1875
Monticello.....	Jones.....	21.4	30	17.9	-3.5	34.6	1878	7.5	1875
Logan.....	Harrison.....	24.0	15	22.9	-1.1	35.2	1877	12.6	1875
Kansas.									
Lawrence.....	Douglas.....	32.2	25	27.6	-4.6	41.6	1882	20.8	1885
Wellington.....	Sumner.....	32.1	10	31.5	-0.6	40.1	1882	24.6	1885
Louisiana.									
Grand Coteau.....	Saint Landry.....	58.7	6	54.8	-3.9	64.6	1887	52.4	1885
Maine.									
Gardiner.....	Kennebec.....	20.9	48	18.9	-2.0	28.7	1840	13.3	1838
Maryland.									
Cumberland.....	Allegany.....	31.0	30	28.0	-3.0	38.0	1877	19.4	1868
Massachusetts.									
Amherst.....	Hampshire.....	24.7	53	23.2	-1.5	31.4	1857	16.5	1843
Newburyport.....	Essex.....	26.3	10	24.4	-1.9	30.5	1884 '80	19.3	1885
Somerset.....	Bristol.....	27.7	16	25.3	-2.4	33.0	1884	19.6	1885
Michigan.									
Kalamazoo.....	Kalamazoo.....	25.3	13	21.2	-4.1	35.0	1882	11.2	1885
Thornville.....	Lapeer.....	24.5	12	18.3	-6.2	34.8	1882	10.6	1885
Minnesota.									
Minneapolis.....	Hennepin.....	14.2	24	10.4	-3.8	29.9	1877	-2.6	1875
Montana.									
Fort Shaw.....	Lewis & Clarke.....	25.7	19	24.4	-1.3	39.6	1877	2.4	1887
New Hampshire.									
Concord.....	Merrimack.....	22.5	29	21.2	-1.3	32.1	1868	14.7	1836
New Jersey.									
Moorestown.....	Burlington.....	31.2	26	27.1	-4.1	37.2	1865	21.6	1885
South Orange.....	Essex.....	29.6	18	25.2	-4.4	34.3	1877	22.8	1885
New York.									
Cooperstown.....	Otsego.....	21.0	35	16.1	-4.9	31.7	1857	10.5	1885
Palermo.....	Oswego.....	21.6	35	18.4	-3.2	27.8	1859	9.8	1885
North Carolina.									
Lenoir.....	Caldwell.....	40.0	16	35.9	-4.1	46.5	1887	30.3	1875
Ohio.									
N'th Lewisburgh.....	Champaign.....	30.1	57	27.1	-3.0	43.0	1851	19.0	38 '56 '75
Wauseon.....	Fulton.....	25.5	19	20.2	-5.3	35.4	1882	11.3	1875
Oregon.									
Albany.....	Linn.....	40.4	10	44.8	+4.4	47.9	1885	32.7	1887
Eola.....	Polk.....	39.7	18	42.6	+2.9	46.5	1885	31.0	1887
Pennsylvania.									
Dyberry.....	Wayne.....	22.2	24	17.4	-4.8	29.1	1867	13.3	1868
Grampian Hills.....	Clearfield.....	24.6	24	18.4	-6.2	32.0	1882	13.7	1885
Wellsborough.....	Tioga.....	26.5	9	18.8	-7.7	32.4	1882	16.7	1885
South Carolina.									
Statesburgh.....	Sumter.....	50.1	8	43.3	-6.8	55.1	1884	41.8	1885
Tennessee.									
Austin.....	Wilson.....	43.0	20	39.1	-3.9	51.1	1882	32.9	1885
Milan.....	Gibson.....	40.6	5	36.1	-4.5	48.0	1887	33.8	1885
Texas.									
Fort Concho.....	Tom Green.....	49.8	16	50.1	+0.3	56.5	1882	45.7	1885
New Ulm.....	Austin.....	50.2	15	55.0	+4.8	62.0	1882	52.6	1883
Vermont.									
Strafford.....	Orange.....	18.2	15	14.2	-4.0	25.7	1877	11.0	1885
Virginia.									
Bird's Nest.....	Northampton.....	41.1	20	33.9	-7.2	47.8	1880	33.9	1889
Wytheville.....	Wythe.....	37.2	24	31.5	-5.7	43.0	1884	29.8	1885
Wisconsin.									
Madison.....	Dane.....	20.9	22	14.1	-6.8	32.8	1878	8.1	1885
Washington.									
Fort Townsend.....	Jefferson.....	40.6	17	42.8	+2.2	47.0	1885	31.7	1887

#### MAXIMUM AND MINIMUM TEMPERATURES.

The highest temperatures for the month occurred in the lower Rio Grande valley, where a reading of 92° was reported. Values above 80° were noted over southern and eastern Florida, southern Georgia, southeastern Alabama, east-central Texas, northern Louisiana, and southwestern California. At Sacramento, Cal., a maximum temperature of 80° was reported. The lowest maximum temperatures occurred in the valley of the Red River of the North, east-central Wisconsin, and northern Michigan, where they fell below 40°. Over the northeastern part of the middle plateau region of the Rocky Mountains the maximum temperatures were below 50°. At the following-named stations the maximum temperatures were higher than for any preceding February during the periods of observation: Savannah and Atlanta, Ga., and Shreveport, La., 1° above record of 1883; Little Rock, Ark., 1° above record of 1882;



Brownsville, Tex., 4° above record of 1884; San Diego, Cal., 2° above record of 1883; Sacramento, Cal., and Olympia, Wash., 1° above record of 1888. The most notable deficiencies occurred in the middle Atlantic states, the upper Mississippi and Missouri valleys, the upper lake region, and over the southern plateau, where, at stations, the maximum temperatures were 20°, or more, below the maximum values for the corresponding month of previous years.

The lowest temperatures in the United States were reported in the valley of the Red River of the North, where a reading of -43° was noted at Saint Vincent, Minn. The temperature fell below -30° over northern Minnesota, northern Dakota, and northeastern Montana. A reading of -32° was reported at Northfield, Vt. The minimum temperature fell to zero at stations north of an almost direct line traced from southern New England to central Arizona, and east of a line traced irregularly northward from central Arizona to northwestern Montana.

Unusually low temperatures have not been reported, and at a large majority of stations the minimum readings were considerably above the lowest values previously noted for February, notably in the northern and middle plateau regions of the Rocky Mountains and along the north Pacific coast, where, at stations, the minimum temperature was 20° to 30° above the lowest February values of previous years.

#### RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at Signal Service stations are given in the table of miscellaneous meteorological data. The greatest monthly ranges occurred over northern Minnesota, northern Dakota, and northeastern Montana, where they exceeded 80°. From this region the ranges decreased westward to the Pacific coast, where they were less than 30° over western Washington, and eastward to the Atlantic, where they amounted to less than 50° on the south New England coast. The monthly ranges also decreased from Montana southward to the Mexican border, where they averaged about 50°; southeastward to southern Florida, where they fell below 30°; and southwestward to west-central California, where they were less than 40°.

The following are some of the extreme monthly ranges:

Greatest.		Least.	
Poplar River, Mont.....	92.0 <sup>o</sup>	Key West, Fla.....	25.0 <sup>o</sup>
Fort Assinaboine, Mont.....	84.0	Port Angeles, Wash.....	25.0
Duluth, Minn.....	83.0	Galveston, Tex.....	27.0
Bismarck, Dak.....	82.0	San Francisco, Cal.....	36.0
Valentine, Nebr.....	81.0	Salt Lake City, Utah.....	43.0
Northfield, Vt.....	80.0	Fort Grant, Ariz.....	43.0

#### LIMITS OF FREEZING WEATHER.

The southern and western limits of freezing weather for February, 1889, are shown on chart v. A line representing the southern limit is traced from the eastern coast of Florida, in about lat. N. 30°, westward through New Orleans, La., to south-central Texas, and thence south of west into the middle Rio Grande valley. A line indicating the western limit is traced from southwestern Arizona irregularly northwestward through California to the coast in about lat. N. 39°. As compared with lines representing similar data, traced for the preceding month, a southward advance of freezing weather is shown along the middle and east Gulf coasts and in the Colorado Valley. In southeastern Texas the line for February trends more to the northward. On the Pacific coast the limit of freezing weather remains about the same as in January, 1889.

#### FROST.

As compared with the preceding month the southern limit of frost in Florida has changed but slightly; no frost was, however, reported in the state west of the eighty-second meridian, whereas in January it was noted along the Gulf coast as far south as Manatee county. Along the middle Gulf coast frost occurred frequently during both January and February, while along the west Gulf coast and in southern Texas the southern limit in February was about five degrees farther north than in the preceding month. In southwest California south of the thirty-fifth parallel frost was reported on the 1st, 6th to 8th, 15th to 19th, and 27th.

#### TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for February, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Canby, Fort, Wash.....	48.8	44.3	4.5	46.4	45.2
Cedar Keys, Fla.....	69.8	48.1	21.7	58.3	54.0
Charleston, S. C.....	54.0	48.2	5.8	50.3	47.4
Eastport, Me.....	37.3	36.0	1.3	36.7	20.0
Galveston, Tex.....	63.0	50.0	13.0	54.6	54.4
Key West, Fla.....	77.2	67.3	9.9	71.5	69.4
New York City.....	35.0	30.0	5.0	32.3	28.0
Pensacola, Fla.....	59.0	51.0	8.0	55.4	51.9
Portland, Oregon.....	44.0	39.0	5.0	42.1	44.2

#### PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for February, 1889, as determined from the reports of nearly 1,500 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data are given, for each Signal Service station, the total precipitation, with the departure from the normal. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The precipitation for February was below the normal in the plateau and Pacific coast regions, west Gulf states, and, with the exception of a slight excess in the upper lake region and south Atlantic states, in all districts east of the Mississippi River. In those districts where the precipitation was deficient the percentages of the normal were about as follows: Northern plateau, 7; middle Pacific coast region, 16; southern California, Oregon, and Washington Territory, from 41 to 44; middle plateau region, 48; New England, lower lake region,

upper Mississippi and Ohio valleys, Gulf States, and southern plateau, from 58 to 67; middle Atlantic states, 83; and Florida, 92. It will thus be seen that the deficiency was greatest in the northern and central plateau regions and on the Pacific coast, where, as a whole, there was less than one-third of the normal precipitation for February.

Over the eastern Rocky Mountain slope, extreme northwest, Missouri and Rio Grande valleys, and, as previously stated, in the upper lake region and south Atlantic states, the precipitation of February was above the normal. It exceeded the normal by about 40 per cent. over the eastern Rocky Mountain slope, and in the lower Rio Grande valley there was more than double the normal amount. In other districts where there was an excess the departures were not marked.

With respect to the marked deficiency of rainfall on the Pacific coast the months of January and February were not unlike, and therefore the aggregate rainfall for these months in that region was unusually small. There was, however, in California a decided excess over the normal in both November and December, 1888, but on the north Pacific coast a marked

deficiency occurred in December with scarcely the normal amount for November.

#### DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken, and from which the average has been computed; (3) the total precipitation for February, 1889; (4) the departure of the current month from the average; (5) the extreme monthly precipitation for February.

State and station.	County.	(1) Average for the month of Feb.	(2) Length of record.	(3) Total for Feb., 1889.	(4) Departure from average.	(5) Extreme monthly precip- itation for February.			
						Greatest.		Least.	
		Inches	Years	Inches	Inches	Am't.	Year.	Am't.	Year.
Arkansas.									
Lead Hill .....	Boone .....	5.44	7	2.57	-2.57	10.93	1884	1.47	1885
California.									
Sacramento .....	Sacramento ..	2.81	39	0.42	-2.39	8.50	1854	0.12	1852
Colorado.									
Fort Lyon .....	Bent .....	0.19	15	T.	-0.19	0.86	1874	0.00	1880
Connecticut.									
Middletown .....	Middlesex .....	4.10	26	1.81	-2.29	7.56	1887	1.14	1877
Florida.									
Merritt's Island ..	Brevard .....	2.77	11	4.96	+2.19	6.01	1888	0.15	1882
Georgia.									
Forsyth .....	Monroe .....	4.20	15	6.74	+2.54	7.90	1882	1.19	1879
Illinois.									
Peoria .....	Peoria .....	2.11	33	0.84	-1.27	5.45	1887	0.06	1877
Riley .....	McHenry .....	2.11	38	1.21	-0.90	6.00	1862, '65	0.03	1877
Indiana.									
Logansport .....	Cass .....	4.10	13	1.99	-2.11	9.01	1857	0.15	1868
Vevay .....	Switzerland ..	3.73	23	1.47	-2.26	10.23	1884	0.40	1877
Iowa.									
Cresco .....	Howard .....	1.01	17	0.56	-0.45	1.88	1887	0.07	1877
Monticello .....	Jones .....	1.92	36	0.79	-1.13	4.62	1887	0.32	1877
Logan .....	Harrison .....	1.42	21	T.	-1.42	5.30	1881	T.	1889
Kansas.									
Lawrence .....	Douglas .....	1.23	23	2.20	+0.97	4.60	1881	0.03	1870
Wellington .....	Sumner .....	1.12	10	1.00	-0.12	3.73	1883	0.15	1879
Louisiana.									
Grand Coteau .....	St. Landry ..	3.01	6	1.53	-1.48	7.44	1888	1.37	1886
Maine.									
Gardiner .....	Kennebec .....	3.55	49	1.84	-1.71	9.47	1853	0.58	1877
Maryland.									
Cumberland .....	Allegany .....	2.48	16	2.07	-0.41	4.93	1882	0.60	1877
Massachusetts.									
Amherst .....	Hampshire ..	3.19	54	1.46	-1.73	6.69	1853	0.36	1877
Newburyport .....	Essex .....	4.52	10	2.30	-2.22	6.75	1880	2.30	1889
Somerset .....	Bristol .....	3.92	16	2.12	-1.80	8.70	1886	1.00	1877
Michigan.									
Kalamazoo .....	Kalamazoo ..	2.83	13	1.35	-1.48	5.44	1881	0.12	1877
Thornville .....	Lapeer .....	2.10	12	1.17	-0.99	4.08	1884	0.00	1877
Minnesota.									
Minneapolis .....	Hennepin .....	1.14	23	1.36	+0.22	2.80	1869	T.	1877
Montana.									
Fort Shaw .....	Lewis & Clarke	0.39	19	0.70	+0.31	1.04	1886	0.05	1877
New Hampshire.									
Concord .....	Merrimack ..	3.04	8	1.53	-1.51	5.55	1876	0.40	1883
New Jersey.									
Moorestown .....	Burlington ..	3.45	26	2.27	-1.18	6.02	1886	0.53	1877
South Orange .....	Essex .....	3.77	18	2.49	-1.28	6.10	1881	1.10	1877
New York.									
Cooperstown .....	Otsego .....	2.15	35	1.79	-0.36	5.21	1887	0.60	1856
Palermo .....	Oswego .....	2.85	35	2.83	-0.02	7.20	1866	0.10	1877
North Carolina.									
Lenoir .....	Caldwell .....	4.29	17	2.40	-1.89	9.00	1873	0.60	1877
Ohio.									
N. Lewisburgh ..	Champaign ..	3.23	17	0.90	-2.33	8.20	1883	0.35	1872
Wauseon .....	Fulton .....	3.01	15	1.77	-1.24	7.19	1887	0.12	1877
Oregon.									
Albany .....	Linn .....	6.49	11	0.95	-5.54	13.08	1881	0.95	1889
Eola .....	Polk .....	5.59	19	0.35	-5.24	13.24	1872	0.35	1889
Pennsylvania.									
Dyberry .....	Wayne .....	2.68	23	2.10	-0.58	5.39	1884	0.60	1877
Grampian Hills ..	Clearfield .....	3.43	17	1.96	-1.47	7.62	1887	1.36	1872
Wellsborough .....	Tioga .....	0.59	9	2.98	-3.61	10.93	1884	0.95	1887
South Carolina.									
Statesburgh .....	Sumter .....	2.47	7	5.47	+3.00	5.47	1889	1.18	1883
Tennessee.									
Austin .....	Wilson .....	5.38	20	3.71	-1.67	12.57	1887	0.75	1868
Milan .....	Gibson .....	5.08	5	1.31	-3.77	7.96	1884	1.31	1889
Texas.									
Fort Concho .....	Tom Green ..	0.85	16	2.57	+1.72	3.38	1882	0.00	1879
New Ulm .....	Austin .....	4.54	16	2.73	-1.81	10.90	1882	1.06	1885
Vermont.									
Strafford .....	Orange .....	2.76	15	3.25	+0.49	5.90	1887	0.30	1877
Virginia.									
Bird's Nest .....	Northampton	3.65	20	5.80	+2.15	6.55	1884	1.40	1877
Wytheville .....	Wythe .....	3.32	24	3.30	-0.02	8.00	1862	0.30	1877
Wisconsin.									
Madison .....	Dane .....	1.72	24	1.84	+0.12	7.96	1869	0.30	1877
Washington.									
Fort Townsend ..	Jefferson .....	1.90	14	0.54	-1.36	3.94	1879	0.37	1886

#### HAIL.

Hail occurred during February, as follows: 4th, Independence, Iowa. 5th, Cornish, Me. 8th, Nashville, Tenn. 11th, Banning, Cal. 13th, Albany, Astoria, and Mount Angel, Oregon; Port Angeles, Wash.; Embarrass, Wis. 14th, Fort Bowie and Phoenix, Ariz. 15th, Tucson, Ariz.; Fresno, Cal.; Ypsilanti, Mich.; Wauseon, Ohio. 16th, Sacramento, Cal.; Elkader, Iowa; Leavenworth, Kans.; Cornish, Me.; Ironton, Mo.; Berlin Mills, N. H.; Factoryville and Nineveh, N. Y.; Wauseon, Ohio. 17th, New Market, Ala.; Chattanooga, Tenn. 18th, Holyoke and Westborough, Mass.; Albany, Ardenia, and Boyd's Corners, N. Y.; Cedar Springs, S. C. 19th and 20th, Quitman, Ga. 21st, Forsyth and Hepzibah, Ga. 26th, Washington, N. C. 27th, Vevay, Ind.; Frederick, Md. 28th, Jewell, Md.; Dale Enterprise, Va.

#### SLEET.

Sleet occurred during February as follows: 1st, Blue Hill Observatory and Dudley, Mass; Walla Walla, Wash. 3d, Delphi, Ind. 4th, New London, Conn.; Saint Louis, Mo. 5th, Eastport, Me.; Fox Creek, Mo.; Geneva, Oswego, and Utica, N. Y. 6th, Dudley, Mass. 7th, Cairo and McLeansborough, Ill.; Franklin, Ind.; Walla Walla, Wash. 8th, Cairo and Irishtown, Ill.; Cedar Springs, S. C.; Chattanooga and Milan, Tenn. 10th, Louisville, Palo Alto, and University, Miss. 11th, Fort Buford, Dak.; Augusta, Ga.; Southport, N. C.; Cape Henry, Va. 13th, Fort Yates, Dak.; Sheldon, Mont.; Embarrass, Wis. 14th, Whipple Barracks, Ariz.; Dwight, Ill.; Wesley, Iowa; North Loup, Nebr. 15th, Chicago and Watseka, Ill.; Angola, Ind.; Clear Lake, Davenport, Webster City, and Wesley, Iowa; Detroit and Marquette, Mich.; Duluth, Minn.; Columbus and West Milton, Ohio; San Antonio, Tex.; Milwaukee, Oshkosh, and Weston, Wis. 16th, Lewis Creek, Cal.; New Hartford, Conn.; Kirkwood, Del.; Des Moines, Fayette, and Oskaloosa, Iowa; Bendena, Globe. La Harpe, Leoti, and Yates Centre, Kans.; Holyoke, Mass.; Detroit and Sault de Ste. Marie, Mich.; University, Miss.; Oregon, Mo.; Manchester and North Sutton, N. H.; Humphrey and Palermo, N. Y.; Le Roy, Reading, and Wellsborough, Pa.; Northfield, Vt.; Lynchburgh, Va.; Hartmonsville, W. Va. 17th, Cairo and Golconda, Ill.; New Providence, Ind.; Fort Reno, Ind. T.; University, Miss.; Kidder and Springfield, Mo.; Locktown, N. J.; Northfield, Vt. 18th, New Hartford, Conn.; Blue Hill Observatory and Holyoke, Mass.; Geneva and Oswego, N. Y.; Columbus and Garrettsville, Ohio; Hartmonsville, W. Va. 20th, Mobile, Ala.; Mandeville, Mount Airy, and New Orleans, La.; Pearlinton, Miss.; Washington, N. C. 21st, Montgomery, Ala.; Augusta, Milledgeville, and Savannah, Ga.; Southport, N. C. 22d, Kidder, Mo.; Elyria, Ohio. 23d, Colorado Springs, Colo.; Kidder, Mo.; Westerville, Ohio. 24th, Santa Maria, Cal. 25th, Santa Maria, Cal.; Old Duquoin, Ill.; Saint Louis and Springfield, Mo.; Fort Elliott, Tex. 26th, Fort Collins, Colo.; Cairo, Charleston, and Greenville, Ill.; De Gonia Springs, Ind.; Mount Saint Mary's, Md.; Ironton, Mo.; Washington and Wilmington, N. C.; Garrettsville, Ohio. 27th, Fort Collins, Colo.; New Hartford, Conn.; Washington City; Baltimore, Md.; Geneva and New York City, N. Y.; Hartmonsville, W. Va. 28th, North Billerica, Mass.

#### SNOW.

There were no dates during February on which snow did not fall in Vermont and New York. In Pennsylvania and Ohio there was but one day on which it did not occur. With the exception of the 14th and 28th, snow was of daily occurrence in Michigan, and it fell on from twenty to twenty-four days during the month in Montana, Dakota, Minnesota, Wisconsin, Kansas, Missouri, West Virginia, Massachusetts, New Hampshire, and Maine. It was least extensively reported on the 1st and 2d, and most extensively reported on the 8th, 24th, and 25th. The southernmost latitude, about 32°, was reached on the 20th and 21st, being about two degrees north of the southern limit for the previous month.



## MONTHLY SNOWFALLS (inches and tenths) FEBRUARY, 1889.

The monthly snowfall of February exceeded twenty inches over a considerable portion of the Lake region and New England, and in a few cases some remarkably large falls were recorded. Stations in Michigan, northern New York, and northern New England report more than forty inches, and extreme depths of 69.6 and 71.4 were recorded, respectively, at Barnes' Corners and Lowville, in Lewis Co., New York. Along the Atlantic coast, south of New England, the monthly falls reached six inches in but few instances, and for the most part ranged between one and four inches. Over a narrow area extending from northern Georgia northeastward to West Virginia the monthly falls were generally above ten inches, and exceeded twelve at a few stations. In the lower Ohio valley, Tennessee, Iowa, and the greater part of Nebraska, there was very little snow during the month. Florida and Louisiana are the only states in which no snow fell during the month.

Below are given all monthly snowfalls of ten inches, or more, and in states or territories where the maximum depth was below that amount, the station reporting the greatest is given: *Alabama*.—Troy, 0.1. *Arizona*.—Williams, 17; Prescott, 12; Cedar Springs, 11.2. *Arkansas*.—Ozone, 6. *California*.—Summit, 15; Cisco, 14; Emigrant Gap, 11. *Colorado*.—Ouray, 14.3; Glenwood Springs, 12.8; Rifle Falls, 12.1; T. S. Ranch, 11. *Connecticut*.—New London, 12. *Dakota*.—Bismarck, 15.7; Rapid City, 13.5; Grand Forks and Spearfish, 12.5; Webster, 12; Huron, 11.1; Kimball, 10. *Delaware*.—Newark, 1.8. *District of Columbia*.—Washington City, 3.5. *Georgia*.—Athens, 7.5. *Idaho*.—Fort Sherman, 8. *Illinois*.—Lake Forest, 19.2; Fort Sheridan, 19; Kankakee, 13.2; Mahomet, 10.9; Griggsville, Philo, and Springfield, 10.6; Pekin, 10.5; Rockford, 10.4; Belvidere, Dwight, and Pana, 10. *Indiana*.—Columbia City, 12.8; Huntertown, 11.8. *Indian Territory*.—Fort Reno and Tulsa, 1. *Iowa*.—Cromwell, 12.5; Clear Lake, 11.5; Davenport, 10.1. *Kansas*.—Winfield, 12; Grenola, 10. *Kentucky*.—Catlettsburgh, 8. *Maine*.—Kent's Hill, 33; Orono, 28.3; Eastport, 24.9; Cornish, 20; Lewiston, 19; Gardiner, 18; Bar Harbor, 15.5; Belfast, 14. *Maryland*.—Fort McHenry, 8. *Massachusetts*.—Nantucket b, 18; Royals-ton, 13.1; Gilbertville and Provincetown, 13; Williamstown, 11.4; Nantucket a, 11; Brewster, Deerfield, Cotuit, and Middleborough, 10. *Michigan*.—Bear Lake, 44.2; Fremont, 41.2; Benzonia and Calumet, 39; Traverse City, 37.5; Deer Lake, 37; Atlantic, 35; Manistee, 33.4; Hart, 29.5; Benton Harbor, 28; Berrien Springs, 27.8; Cassopolis and Montague, 27; Alpena, 26.9; Grand Haven, 25.4; Marquette, 23.7; May, 23.5; Harrisville, 23; Big Rapids, 22; Northport, 21.8; Alma, 21.5; Rosecommon, 20.7; East Saginaw, 20.3; Omer, 20; Gulliver Lake and Vandalia, 19.4; Colon and East Tawas, 18; Hastings, 17.9; Stanton, 17.8; Lathrop, 16.3; Flint, 15.5; Hillman and Marshall, 15; Port Huron, 14.8; Worthington, 14.7; Swartz Creek, 14.4; Gladwin, 14.2; Berlin, Bronson, Eden, Paw Paw, and Thomasville, 14; State Capitol, 13.8; Highland Station, 13.5; Fort Wayne, 13.3; Lansing, Kalamazoo, and Olivet, 13.2; Sand Beach, 13.1; Hudson and Williamston, 13; Corunna and Ypsilanti b, 12.5; Sault de Ste. Marie, 11.7; Saint John's, 11.6; Mottville, 11.2; Ovid, 11; Ypsilanti a, 10.9; Adrian, 10. *Minnesota*.—Pokegama Falls, 17.3; Duluth, 15.2; Lake Winnebago and Leech Lake, 14.6; Minneapolis, 13.1; Saint Paul, 12; Delano, 11. *Mississippi*.—Palo Alto and Pontotoc, trace. *Missouri*.—Springfield a, 13; Springfield b, 11; Fox Creek and Pierce City, 10.5; Harrisonville, 10.3. *Montana*.—Fort Keogh, 16.8; Fort Maginnis, 16.6; Fort Missonla, 11.4; Sheldon, 10.9. *Nebraska*.—Valentine, 12.5. *Nevada*.—Burner's Ranch, 26; Pioche, 12. *New Hampshire*.—North Conway, 26; Berlin Mills, 21; Plymouth, 20; Hanover, 19; Walpole and West Milan, 18; North Sutton, 14.5; Antrim and Concord, 12; Manchester c, 11; Chesterfield, Manchester a, and Manchester b, 10. *New Jersey*.—South Orange, 10. *New Mexico*.—Fort Wingate, 19.2; Coolidge, 14. *New York*.—Lowville, 71.4; Barnes' Corners, 69.6; Number Four, 54.2; Constableville, 49; Utica, 44.2; Potsdam,

41; Oswego, 37.2; Saranac Lake, 35.2; North Hammond, 28.6; Eden, 26.5; Buffalo, 26.1; Palermo, 26; Nineveh, 25; Ilion, 23.6; Hess Road Station, 23.3; Canton, 23.1; Rochester, 22; Wedgewood, 21; Fort Porter, 20.3; Queensbury, 20; South Canisteo, 16; Perry City, 15.9; Humphrey, 15.5; Geneva, 15.2; Angelica, 15; Le Roy, 14.9; Friendship, 14.5; Factoryville, 13.9; Cooperstown, 13; Penn Yan, 11; Ithaca, 10.7; Lyons, 10.5; White Plains, 10. *North Carolina*.—Mount Pleasant, 11.2; Southern Pines, 10.9; Chapel Hill, 10.5; Raleigh, 10.3. *Ohio*.—Wauseon, 19.1; Ruggles, 18; Canton, 17.5; Kent, 17; Napoleon, 12.2; Gracey, 11.8; Worcester, 11.4; Garrettsville, 10.6; Tiffin, 10.5. *Oregon*.—Tillamook, 4.5. *Pennsylvania*.—Salem Corners, 21.1; Pleasant Mount, 19.5; Philipsburgh, 17.8; Wellsborough, 17.6; Grampian Hills, 17; Troy, 15.5; Nesbit, 15; Blooming Grove, 13.5; Erie, 13; Le Roy, 11.3. *Rhode Island*.—Kingston, 9. *South Carolina*.—Belmont and Clinton, 14; Aiken, 13; Yorkville, 12.8; Cedar Springs and Statesburg, 10. *Tennessee*.—Rogersville, 5.2. *Texas*.—Fort Elliott, 2.2. *Utah*.—Fort Douglas, 10.5. *Vermont*.—Strafford, 36; Northfield, 28.8; Middlebury, 28.4; Chelsea, 26; Jacksonville and Saxton's River, 20; Lunenburg, 18; Brattleborough, 16; Burlington, 15; Cornwall and East Berkshire, 14; Vernon, 10. *Virginia*.—Lynchburgh, 10.7. *Washington Territory*.—Fort Canby, 5. *West Virginia*.—Middlebrook, 32; Hartmonsville, 18. *Wisconsin*.—Portage, 61; Embarrass, 32.8; Manitowoc, 28.6; Oshkosh, 17.5; Milwaukee, 16.3; Green Bay, 16.2; Delavan, 14.2; Weston, 13.4; Glasgow, 12.5; Waucousta, 12. *Wyoming*.—Camp Sheridan, 17.5; Fort McKinney, 12.5.

## DEPTH OF SNOW REMAINING ON GROUND ON 15TH AND AT CLOSE OF MONTH.

With the exception of limited areas in the central Rocky Mountain and plateau regions the portions of the country covered by snow on the 15th were confined principally to the extreme northern districts from Dakota eastward to New England. In the valley of the Red River of the North, and in the extreme northern portions of Minnesota, Michigan, New York, Vermont, and New Hampshire, the depths ranged from ten to twenty inches. In western Kansas there was a small area over which there were from two to five inches.

On chart v are shown the portions of the country covered by snow at the close of February. It will be seen that with the exception of West Virginia there was no appreciable amount south of the fortieth parallel at the close of the month. In the extreme northern districts from Dakota eastward the depths ranged from six inches upwards. Over a considerable area embracing the northern portions of Michigan and Wisconsin there were from fifteen to thirty inches, and similar depths covered portions of New York and New England. An extreme depth of seventy-two inches was reported from Barnes' Corners, N. Y.

## EXCESSIVE PRECIPITATION, FEBRUARY, 1889.

During February no station within the United States or Canada reported a monthly rainfall amounting to ten inches, the largest amount being 7.78 at Neah Bay, Wash.

Daily falls of 2.50 inches or more during the month were confined to the states of Alabama, Georgia, North Carolina, Pennsylvania, South Carolina, Tennessee, and Texas. Of the twenty-six measurements of rainfalls in excess of 2.50 inches recorded, twenty-two occurred between the 15th and 18th, the remaining four occurring on the 27th and 28th. The fall of 4.51 at Statesville, S. C., on the 18th, was the heaviest.

In five instances there were hourly rainfalls of more than 1.00 inch. One of these occurred on the 9th, three on the 17th, and one on the 18th. Two were recorded at the same station, viz., Diamond, Ga., and the others at Wilmington, N. C., Knoxville, Tenn., and Galveston, Tex., respectively. The fall of 2.22 in one hour and thirty minutes at Diamond, Ga., on the 17th, gives the highest rate per hour, 1.48.

Table of excessive precipitation, February, 1889.

State and station.	Monthly rainfall 10 inches or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<i>Alabama.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Decatur .....	3.10	15-16				
Motest .....	4.04	15-16				
Valley Head .....	2.90	16				
<i>Georgia.</i>						
Diamond .....	3.50	15		3.22	1 30	17
Do .....	3.90	15		3.90	3 00	18
Marietta .....	2.55	27				
Milledgeville .....	2.80	15				
Quitman .....	3.50	15				
<i>North Carolina.</i>						
Murphy .....	3.20	16				
Statesville .....	4.51	18				
Wilmington .....				1.04	1 00	17
<i>Pennsylvania.</i>						
Pleasant Mount .....	3.50	16-17				
Do .....	2.50	18				
<i>South Carolina.</i>						
Belmont .....	2.82	17				
<i>Tennessee.</i>						
Charleston .....	3.14	15-16				
Chattanooga .....	3.36	15-16				
Fayetteville .....	3.00	16				
Kingsport .....	2.90	15-16				
Knoxville .....	2.71	17-18		2.00	1 30	17
Lookout Mountain .....	3.10	16				
Parksville .....	2.93	15				
Rockwood .....	2.85	15-16				
Springdale .....	2.50	16				
<i>Texas.</i>						
Brownwood .....	2.81	28				
Camp Pena Colorado .....	4.50	27				
Cleburne .....	3.75	27-28				
Corsicana .....	3.67	27-28				
Galveston .....				1.40	1 00	9
New Braunfels .....	2.53	28				
Reports received too late for January Review.						
<i>New York.</i>						
Brooklyn .....	3.77	27-28				
<i>Texas.</i>						
Victoria .....	10.05	3.00	7-8			

## SUMMARY OF EXCESSIVE PRECIPITATION.

The following table gives the aggregate number of excessive monthly, daily, and hourly rainfalls reported at regular stations of the Signal Service during the periods of observation, and the average interval of their occurrence:

State and station.	Rainfalls of 10 inches, or more, a month.	Average interval of occurrence.	Rainfalls of 2.50 inches, or more, a day.	Average interval of occurrence.	Rainfalls of 1 inch, or more, an hour.	Average interval of occurrence.	Length of record.
<i>Alabama.</i>	<i>Yrs. Mos.</i>		<i>Yrs. Mos.</i>		<i>Yrs. Mos.</i>		<i>Yrs.</i>
Auburn .....	1 1 0		3 0 2		0 0 0		19
Mobile .....	19 1 0		71 0 3		16 1 2		10
Montgomery .....	9 1 9		40 0 5		11 1 5		16
<i>Arizona.</i>							
Fort Apache .....	0 0 0		2 5 0		9 1 1		10
Fort Bowie .....	0 0 0		0 0 0		0 0 0		10
Fort Grant .....	0 0 0		3 3 4		6 1 8		10
Fort McDowell .....	0 0 0		1 5 0		0 0 0		8
Fort Thomas .....	0 0 0		0 0 0		1 8 0		12
Fort Verde .....	0 0 0		0 0 0		0 0 0		12
Maricopa .....	0 0 0		0 0 0		0 0 0		12
Phoenix .....	0 0 0		0 0 0		0 0 0		12
Prescott .....	0 0 0		2 6 0		0 0 0		13
Yuma .....	0 0 0		0 0 0		0 0 0		13
<i>Arkansas.</i>							
Fort Smith .....	1 6 0		8 0 9		1 6 0		6
Little Rock .....	5 1 10		25 0 4		13 0 9		9
<i>California.</i>							
Eureka .....	1 2 0		1 2 0		0 0 0		5
Fort Bidwell .....	0 0 0		0 0 0		0 0 0		5
Fresno .....	0 0 0		0 0 0		0 0 0		11
Los Angeles .....	2 5 6		12 0 11		9 1 3		11
Keeler .....	0 0 0		0 0 0		0 0 0		3
Red Bluff .....	4 2 9		0 2 2		1 11 0		11
Sacramento .....	3 3 8		0 1 4		0 0 0		11
San Diego .....	0 0 0		4 4 3		0 0 0		17
San Francisco .....	6 3 2		15 1 3		0 0 0		19
Campo .....	0 0 0		0 0 0		1 5 0		5
Visalia .....	0 0 0		0 0 0		0 0 0		6
<i>Colorado.</i>							
Colorado Springs .....	0 0 0		2 1 6		0 0 0		3
Denver .....	0 0 0		2 9 6		3 6 4		19
Las Animas .....	0 0 0		1 5 0		4 1 3		5
Montrose .....	0 0 0		0 0 0		0 0 0		4
Pike's Peak .....	3 4 8		6 2 4		0 0 0		24

Aggregate number of rainfalls—Continued.

State and station.	Rainfalls of 10 inches, or more, a month.	Average interval of occurrence.	Rainfalls of 2.50 inches, or more, a day.	Average interval of occurrence.	Rainfalls of 1 inch, or more, an hour.	Average interval of occurrence.	Length of record.
<i>Connecticut.</i>	<i>Yrs. Mos.</i>		<i>Yrs. Mos.</i>		<i>Yrs. Mos.</i>		<i>Yrs.</i>
Hartford .....	13 0		10 1 4		0 0 0		13
New Haven .....	6 3 8		29 0 7		1 16 0		16
New London .....	3 6 0		31 0 10		4 4 6		18
<i>Dakota.</i>							
Bismarck .....	0 0 0		1 14 0		0 0 0		14
Fort Buford .....	0 0 0		1 10 0		1 10 0		10
Huron .....	0 0 0		0 0 0		4 1 9		7
Fort Totten .....	0 0 0		2 2 6		0 0 0		5
Yankton .....	0 0 0		9 1 8		4 3 9		15
<i>District of Columbia.</i>							
Washington City .....	4 4 6		13 1 5		7 2 7		18
<i>Florida.</i>							
Cedar Keys .....	10 0 10		29 0 3		12 0 8		8
Jacksonville .....	12 1 7		49 0 5		28 0 8		19
Jupiter .....	0 0 0		2 0 6		0 0 0		1
Key West .....	5 3 10		31 0 7		11 1 9		19
Lake City .....	0 0 0		0 0 0		0 0 0		3
Pensacola .....	7 1 3		41 0 3		5 1 10		9
Sanford .....	4 1 0		0 0 0		0 0 0		4
Titusville .....	0 0 0		6 0 2		7 0 2		1
<i>Georgia.</i>							
Atlanta .....	9 1 0		20 0 5		6 1 6		9
Augusta .....	3 9 6		26 0 9		10 1 11		19
Savannah .....	9 2 1		41 0 6		16 1 2		19
<i>Idaho.</i>							
Boise City .....	0 0 0		0 0 0		0 0 0		11
Fort Sherman .....	0 0 0		0 0 0		0 0 0		6
<i>Illinois.</i>							
Cairo .....	3 5 9		23 0 9		16 1 1		17
Chicago .....	1 19 0		13 1 6		5 3 10		19
Springfield .....	3 2 8		13 0 7		7 1 2		8
<i>Indiana.</i>							
Indianapolis .....	4 4 9		18 1 1		28 0 8		19
Terre Haute .....	0 0 0		1 1 0		0 0 0		1
<i>Iowa.</i>							
Davenport .....	1 19 0		14 1 4		15 1 3		19
Dubuque .....	2 7 6		21 0 9		10 1 6		15
Des Moines .....	2 5 0		18 0 7		12 0 10		10
Keokuk .....	2 8 6		18 0 11		9 1 11		17
<i>Indian Territory.</i>							
Fort Reno .....	0 0 0		8 0 9		0 0 0		6
Fort Sill .....	0 0 0		7 1 5		2 5 0		10
Fort Supply .....	0 0 0		1 11 0		0 0 0		11
<i>Kansas.</i>							
Dodge City .....	1 14 0		7 2 0		11 1 3		14
Concordia .....	0 0 0		0 0 0		0 0 0		3
Leavenworth .....	3 9 6		27 0 8		12 1 7		19
Topeka .....	0 0 0		9 0 3		2 1 0		2
<i>Kentucky.</i>							
Lexington .....	0 0 0		1 1 0		1 1 0		1
Louisville .....	3 5 8		21 0 10		14 1 3		17
<i>Louisiana.</i>							
New Orleans .....	16 1 2		60 0 4		13 1 5		18
Shreveport .....	8 2 2		43 0 5		21 0 10		17
<i>Maine.</i>							
Eastport .....	1 14 0		1 14 0		2 7 0		14
Portland .....	0 0 0		16 1 1		2 8 6		17
<i>Maryland.</i>							
Baltimore .....	1 19 0		22 0 10		13 1 7		19
<i>Massachusetts.</i>							
Boston .....	3 6 4		27 0 8		1 19 0		19
Nantucket .....	0 0 0		1 2 0		3 1 0		2
Springfield .....	5 1 7		5 1 7		0 0 0		8
Vineyard Haven .....	0 0 0		2 1 0		2 1 0		2
Wood's Holl .....	1 9 0		2 4 6		0 0 0		9
<i>Michigan.</i>							
Alpena .....	2 8 0		4 4 0		5 3 2		16
Detroit .....	0 0 0		3 6 4		8 2 4		19
Escanaba .....	1 17 0		5 3 5		3 5 8		17
Grand Haven .....	0 0 0		11 1 7		11 1 7		17
Lansing .....	0 0 0		0 0 0		1 2 0		2
Mackinaw City .....	0 0 0		3 1 4		0 0 0		4
Marquette .....	1 17 0		4 4 3		3 5 8		17
Port Huron .....	0 0 0		1 14 0		2 7 0		14
<i>Minnesota.</i>							
Duluth .....	4 4 6		3 6 0		0 0 0		18
Moorhead .....	0 0 0		5 1 7		4 2 0		8
Saint Vincent .....	0 0 0		8 1 0		5 1 7		8
Saint Paul .....	1 19 0		5 3 10		6 3 2		19
<i>Missouri.</i>							
Lamar .....	0 0 0		7 0 5		9 0 4		3
Saint Louis .....	1 18 0		19 0 11		5 3 7		18
Springfield .....	0 0 0		2 1 0		1 2 0		2
<i>Mississippi.</i>							
University .....	0 0 0		1 1 0		1 1 0		1
Vicksburg .....	13 1 4		43 0 5		6 2 11		17
<i>Montana.</i>							
Fort Assinaboine .....	0 0 0		3 2 8		3 2 8		8
Fort Custer .....	0 0 0		0 0 0		1 9 0		9
Fort Maginnis .....	0 0 0		3 1 8		0 0 0		5
Helena .....	0 0 0		1 7 0		0 0 0		7
Poplar River .....	0 0 0		0 0 0		0 0 0		6
<i>Nebraska.</i>							
Crete .....	0 0 0		1 1 0		0 0 0		1
North Platte .....	0 0 0		2 7 0		7 2 0		14
Omaha .....	6 3 2		16 1 2		22 0 10		19
Valentine .....	0 0 0		1 3 0		0 0 0		3
<i>Nevada.</i>							
Pioche .....	0 0 0		0 0 0		0 0 0		6



## Aggregate number of rainfalls—Continued.

State and station.	Rainfalls of 10 inches, or more, a month.	Average interval of occurrence.	Rainfalls of 2.50 inches, or more, a day.	Average interval of occurrence.	Rainfalls of 1 inch, or more, an hour.	Average interval of occurrence.	Length of record.
<i>Nevada—Continued.</i>							
Carson City.....	0	Yrs. Mos.	0	Yrs. Mos.	0	Yrs. Mos.	Yrs.
Winnemucca.....	0		0		0		1
<i>New Hampshire.</i>							
Manchester.....	0		1	1 0	0		1
Mount Washington.....	36	0 5	1	15 0	0		15
<i>New Jersey.</i>							
Atlantic City.....	2	7 6	12	1 3	2	7 6	25
Barnegat City.....	3	4 0	6	2 0	0		12
Cape May.....	1	4 4	5	3 7	0		13
Little Egg Harbor.....	1	4 0	2	2 0	0		4
Sandy Hook.....	5	2 5	7	1 9	0		12
<i>New Mexico.</i>							
Fort Stanton.....	0		0		0		4
Lave.....	0		0		0		4
Santa Fe.....	0		1	14 0	2	7 0	14
<i>New York.</i>							
Albany.....	0		2	7 6	3	5 0	15
Buffalo.....	1	19 0	8	2 4	4	4 9	19
Oswego.....	1	19 0	11	1 9	0		19
New York City.....	2	5 6	23	1 0	5	3 10	19
Rochester.....	0		4	4 6	1	15 0	18
<i>North Carolina.</i>							
Charlotte.....	3	3 3	21	0 6	7	1 5	10
Fort Macon.....	0		7	0 10	0		6
Hatteras.....	17	0 10	65	0 3	22	0 8	14
Kitty Hawk.....	9	1 7	17	0 10	0		14
New River Inlet.....	1	1 0	7	0 3	0		1
Portsmouth.....	1	4 0	8	0 6	1	4 0	4
Raleigh.....	3	0 8	2	1 0	4	0 6	2
Southport.....	4	3 3	17	0 9	2	6 6	13
Wilmington.....	10	1 08	59	0 4	24	0 9	18
<i>Ohio.</i>							
Cincinnati.....	0		15	1 2	5	3 7	18
Cleveland.....	0		11	1 9	5	3 10	19
Columbus.....	0		4	2 6	5	2 0	10
Sandusky.....	1	10 0	5	2 0	6	1 8	10
Toledo.....	0		3	9 0	9	2 0	18
<i>Oregon.</i>							
Ashland.....	0		0		0		5
Astoria.....	9	0 7	5	1 0	0		5
Fort Klamath.....	0		0		0		3
Linkville.....	0		0		0		5
Portland.....	22	0 10	14	1 4	0		19
Roseburg.....	1	10 0	7	1 3	0		10
<i>Pennsylvania.</i>							
Erie.....	0		8	1 10	5	3 0	15
Philadelphia.....	1	19 0	19	1 0	9	2 1	19
Pittsburgh.....	0		11	1 8	19	1 0	18
<i>Rhode Island.</i>							
Block Island.....	1	8 0	13	0 7	3	2 8	8
Narragansett Pier.....	1	6 6	1	6 0	0		6
Point Judith.....	0		0		0		2
Newport.....	1	8 0	8	1 0	0		8
<i>South Carolina.</i>							
Charleston.....	17	1 1	57	0 4	20	0 11	18
Columbia.....	0		1	1 0	1	1 0	1
<i>Tennessee.</i>							
Chattanooga.....	5	2 0	27	0 4	21	0 6	10
Knoxville.....	6	3 0	31	0 7	28	0 8	18
Memphis.....	6	2 10	45	0 5	14	1 3	17
Nashville.....	3	6 0	20	0 11	21	0 10	18
<i>Texas.</i>							
Ahilene.....	0		1	3 0	2	1 6	3
Brownsville.....	7	1 10	34	0 5	10	1 4	13
Fort Davis.....	0		5	1 10	5	3 0	9
Fort Elliott.....	0		7	1 3	5	1 1	9
Fort Concho.....	3	2 4	6	1 2	2	3 6	7
Galveston.....	10	1 9	74	0 3	29	0 7	17
Corpus Christi.....	0		2	1 0	2	1 0	2
Palestine.....	1	5 0	21	0 3	6	0 10	5
El Paso.....	0		1	10 0	4	3 6	10
Rio Grande City.....	1	11 0	20	0 7	5	1 4	11
San Antonio.....	0		5	1 10	8	1 1	9
<i>Utah.</i>							
Frisco.....	0		0		0		2
Salt Lake City.....	0		0		0		14
Fort Du Chesne.....	0		0		0		1
<i>Vermont.</i>							
Northfield.....	0		0		0		1
Burlington.....	0		0		0		12
<i>Virginia.</i>							
Cape Henry.....	3	5 0	1	15 0	0		15
Chincoteague.....	0		0		0		7
Lynchburg.....	3	6 0	12	1 6	9	2 0	18
Norfolk.....	2	9 6	27	0 8	6	3 2	19
Wytheville.....	0		5	0 10	3	1 4	4
<i>Washington Territory.</i>							
Dayton.....	0		1	6 0	0		6
Fort Canby.....	7	0 9	3	1 8	0		5
Neah Bay.....	17	0 3	0		0		4
Olympia.....	15	0 9	7	1 7	0		11
Port Angeles.....	0		0		0		5
Pysht.....	6	0 6	2	1 6	0		3
Spokane Falls.....	0		0		0		7
Tatoosh Island.....	21	0 3	39	0 2	0		5
Walla Walla.....	0		0		0		5
<i>Wisconsin.</i>							
Green Bay.....	0		1	2 0	1	2 0	2
La Crosse.....	2	8 0	10	1 7	8	2 0	16

## Aggregate number of rainfalls—Continued.

State and station.	Rainfalls of 10 inches, or more, a month.	Average interval of occurrence.	Rainfalls of 2.50 inches, or more, a day.	Average interval of occurrence.	Rainfalls of 1 inch, or more, an hour.	Average interval of occurrence.	Length of record.
<i>Wisconsin—Continued.</i>							
Milwaukee.....	0	Yrs. Mos.	5	3 10	5	3 10	19
<i>Wyoming.</i>							
Cheyenne.....	0		0		5	3 10	19
Fort Bridger.....	0		0		0		4
Fort Laramie.....	0		0		0		1
Fort McKinney.....	0		0		1	1 0	1
Fort Washakie.....	0		0		0		1

The following results have been determined from records, which, in instances, represent combined records, furnished this office by voluntary observers or correspondents:

State and station.	Rainfall of 10 inches, or more, a month.	Average interval of occurrence.	Rainfalls of 1 inch, or more, an hour.	Average interval of occurrence.	Length of record.
<i>California.</i>					
San Francisco.....	6	Yrs. Mos.	4 8	Yrs. Mos.	Yrs.
Sacramento.....	7		4 3		28
San Luis Obispo.....	4		3 0		30
<i>Connecticut.</i>					
Wallingford.....	5		6 2		13
<i>District of Columbia.</i>					
Washington City.....	12		4 2		31
<i>Florida.</i>					
Merritt's Island.....	11		0 9		50
<i>Georgia.</i>					
Macon.....	3		4 0		8
<i>Illinois.</i>					
Marengo.....	2		18 0		12
<i>Indiana.</i>					
Laconia.....	1		17 0		36
Wabash.....	0				17
<i>Indian Territory.</i>					
Fort Gibson.....	4		8 3		6
<i>Iowa.</i>					
Hopkinton.....	1		11 0		33
<i>Massachusetts.</i>					
Cambridge (Harvard College).....	3		9 4		11
<i>Missouri.</i>					
New Bedford.....	4		18 9		26
<i>Nebraska.</i>					
Saint Louis.....	9		4 11		75
<i>New Jersey.</i>					
Fort McPherson.....	0				44
<i>New York.</i>					
Newark.....	5		9 0		9
<i>New Hampshire.</i>					
Cooperstown.....	0				45
<i>New Mexico.</i>					
New York City.....	0		66	0 3	34
Palermo.....	0				19
Troy.....	2		29 6		28
<i>Ohio.</i>					
Hanover (Dartmouth College).....	0				59
<i>Pennsylvania.</i>					
Fort Union.....	3		9 4		21
<i>South Carolina.</i>					
North Lewisburgh.....	1		16 0		28
<i>Texas.</i>					
Portsmouth.....	0				16
<i>Virginia.</i>					
Philadelphia.....	5		12 7		26
<i>Wyoming.</i>					
Kirkwood.....	2		10 0		63
<i>Wisconsin.</i>					
New Ulm.....	13		1 2		20
<i>Wyoming.</i>					
Snowville.....	3		4 8		15
Wytheville.....	0				14
Fort Sanders.....	0				18

In the above summary it has been possible to accurately show the average interval of excessive monthly and daily rainfalls as reported at regular stations of the Signal Service. As regards hourly excessive rainfalls, an absence in the past of recording or automatic gauges has rendered it possible and probable that many heavy rainfalls of short duration, more particularly when they have occurred during the progress of general storms, have not been noted.

The table shows that monthly rainfalls to equal or exceed ten inches have occurred most frequently in the extreme

northwest part of Washington, Neah Bay and Tatoosh Island having an average interval of three months. Exclusive of the north Pacific coast stations excessive monthly rainfalls have not been reported at intervals of less than one year, save at points along the North Carolina and Florida coasts, and at Mount Washington, N. H. In Arizona, Colorado (except at Pike's Peak), Dakota, Idaho, Indian Territory, Montana, Nevada, New Mexico, Utah, Vermont, and Wyoming, no monthly rainfalls of ten or more inches have been reported at regular stations of the Signal Service. Among the longer intervals noted are, nineteen years at Chicago, Ill., Baltimore, Md., Saint Paul, Minn., Buffalo and Oswego, N. Y., and Philadelphia, Pa.; eighteen years at Saint Louis, Mo.; seventeen at Escanaba and Marquette, Mich.; fourteen at Dodge City, Kans., and Eastport, Me.; eleven at Rio Grande City, Tex., and ten at Sandusky, Ohio, and Roseburgh, Oregon. The table of data made up from long-period records furnished by voluntary observers, shows an interval of eighteen years at Marengo, Ill.; seventeen at Laconia, Ind.; twenty-nine and one-half at Troy, N. Y.; twelve and one-half at Philadelphia, Pa., and ten for Kirkwood, S. C.

Rainfalls to equal or exceed two and one-half inches in twenty-four hours have occurred most frequently at stations along or near the south Atlantic and Gulf coasts, in Florida, and at Tatoosh Island, Wash., where they have been reported at intervals of two and three months. At points in Alabama,

Arkansas, at Los Angeles, Cal., Connecticut, Florida, Georgia, Illinois, Iowa, Indian Territory, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Missouri, North Carolina, Rhode Island, South Carolina, Tennessee, Texas, and Virginia the intervals varied from four to twelve months. In Idaho, Nevada, Utah, Vermont, and Wyoming excessive daily rainfalls have not been reported. At Bismarck and Fort Buford, Dak., Fort Supply, Ind. T., Eastport, Me., Port Huron, Mich., Mount Washington, N. H., Santa Fé, N. Mex., El Paso, Tex., and Cape Henry, Va., daily rainfalls of two and one-half or more inches have been reported at intervals of from ten to twenty years.

Rainfalls to equal or exceed one inch an hour have been most frequently reported at Titusville, Fla. (with a record of two years), and at the Central Park Meteorological Observatory, New York City (with a record of sixty-six years), where the interval has been two and three months, respectively. At stations in Arkansas, Florida, Indiana, Iowa, Louisiana, eastern Nebraska, North Carolina, western Pennsylvania, South Carolina, Tennessee, and Texas the intervals have varied from four to twelve months. In Nevada, New Hampshire, Oregon, Utah, Vermont, and Washington, no rainfalls of one inch, or more, have been reported at Signal Service stations. At Red Bluff, Cal., New Haven, Conn., Fort Buford, Dak., Boston, Mass., and Rochester, N. Y., excessive hourly rainfalls have been noted at intervals of from ten to twenty years.

## WINDS.

The prevailing winds during February, 1889, are shown on chart i by arrows flying with the wind. In Canada, the Lake region, and generally in districts east of the Mississippi River, westerly winds were most frequently noted, except along the east and middle coasts of the Gulf of Mexico, where they were northeasterly. In Texas, the lower Mississippi valley, the Rocky Mountain regions, and the middle and southern Pacific slopes they were variable. On the north Pacific coast south to west winds predominated.

### HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour, other than those given in the table of miscellaneous meteorological data, have been reported as follows: Fort Assinaboine, Mont., 56, nw., 4th; 66, nw., 3d; Whipple Barracks (Prescott), Ariz., 54, sw., 16th.

### LOCAL STORMS.

The following reports generally refer to storms incidental to the passage of areas of low pressure of pronounced strength whose paths are plotted on chart i:

**4th. Nebraska.**—Omaha: a severe storm began at 6.30 a. m. and continued without cessation until about 7 p. m., causing loss of life and considerable damage to property in this city. Maximum velocity of wind, sixty miles per hour. Reports indicate that the storm was of unusual severity in neighboring towns.—*Report of Signal Service observer.*

**13th. Oregon.**—Shedd's, Linn Co.: a heavy hail storm prevailed for a short time; hail fell to a depth of one inch; some of the stones were one-fourth of an inch in diameter. Lebanon, Linn Co.: quite a hail storm, a few miles in width, was experienced; very little damage was done.—*Oregon Crop-Weather Bulletin.*

**16th. Michigan.**—Sault de Ste. Marie: a severe sleet storm, accompanied by high wind, occurred in the afternoon. Telegraph and telephone wires became heavily coated with ice, cutting off communication with Detroit. Houses on the west side of the street were coated with ice half an inch thick, and all outside business was abandoned during the storm.—*Report of Signal Service observer.*

**16-17th. Tennessee.**—The (Nashville) "Daily American,"

of February 18th, contains the following: a terrific rain storm prevailed between Dark's Mill, Maury Co., and Pulaski, Giles Co., the night of the 16th; it was almost equal to a water-spout in that region. Streams were filled to overflowing, and, in many cases, out-houses in close proximity to the creeks were swept away by the torrents of water. The false work under the proposed new and heavy iron bridge over Rutherford Creek, on the Decatur division, ten miles south of Columbia, was partially swept away.

**17-18th. Tennessee.**—Knoxville: a heavy thunder-storm began 10.30 p. m., 17th, and ended 4 a. m. the following day. The storm was attended by very heavy rain, and the overflow of creeks inundated streets, flooded cellars, etc., in this city.—*Report of Signal Service observer.*

**18th. Alabama.**—Birmingham: about 2 a. m. a storm swept over the lower end of Shelby county, about thirty miles from this city. Many houses were blown down or unroofed; a number of persons were killed and many injured. The storm moved from southwest to northeast, through a thickly populated section.—*The New York Times, February 19th.* **Georgia.**—Harmony Grove, Jackson Co.: about 4.30 a. m. a terrible storm swept across the southeast corner of Banks county, and for violence and damage it was perhaps the most fearful wind storm ever experienced in this section. Houses and trees were driven before the wind like chaff; several persons were killed and a large number injured. The course of the storm was from southwest toward northeast. Persons on the Elberton Air Line state that it crossed that road between Bowersville, Hart Co., and Toccoa, Habersham Co. It is a singular fact that this storm passed in the track of one which occurred in 1846; a hurricane, as it was then called, swept through a large forest and tore up many trees.—*Athens (Ga.) Banner-Watchman.* Griffin, Spaulding Co.: a storm struck this place at 5 a. m., and did considerable damage; it came from the west, and was about three hundred yards wide. At a farm two miles west from here five houses were blown down, and a large barn filled with forage was twisted around.—*Atlanta (Ga.) Constitution.* Eatonton, Putnam Co.: a terrific storm passed a few miles from this place at 7 a. m. The funnel-shaped cloud, as far as can be learned, did its greatest damage in the neighborhood of Nona, this county, on the



Milledgeville and Eatonton Railroad, causing loss of life and considerable injury to property. After leaving Nona the cloud moved in an easterly direction.—*Atlanta (Ga.) Constitution.* South Carolina.—Pacolet, Spartanburgh Co.: about 6 a. m. a tornado passed about a half a mile from this place, and all houses, crops, and lumber over a stretch of country about one-fourth of a mile wide suffered from its ravages.—*Charleston (S. C.) News and Courier.* North Carolina.—Wilmington: a high northwest gale began 9.10 a. m. and ended 1.45 p. m.; maximum velocity of wind, thirty-six miles per hour at 12.10 p. m. Several trees and one frame building were blown down.—*Report of Signal Service observer.*

**21st. Georgia.**—Augusta: a severe snow storm prevailed steadily all day, followed at night by rain and sleet. The approximated depth of snow, which melted as it fell, was about six inches.—*Report of Signal Service observer.* South

Carolina.—Columbia: snow began at 8.20 a. m. and ended 6.30 p. m., followed by sleet and rain, which ended during the night. It was the heaviest fall of snow within the recollection of citizens.—*Report of Signal Service observer.* Gaffney City, Spartanburgh Co.: the deepest snow here in twenty years fell this date; depth twelve to fourteen inches.—*Charleston (S. C.) News and Courier.*

**21st-22d. Michigan.**—Sault de Ste. Marie: high wind, accompanied by blinding snow, began the evening of the 21st, and continued throughout the following day. Maximum velocity of wind one hundred and thirty-two miles per hour from the northwest, at 5 p. m., 22d. The wind was the severest ever experienced at this place, and caused much damage to the telegraph, telephone, and electric light wires. Trains due here from various points were blockaded by the drifting snow.—*Report of Signal Service observer.*

### INLAND NAVIGATION.

#### STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations; the highest and lowest depths for February, 1889, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, February, 1889 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La. ....	29.9	3	31.9	28	20.5	11.4
<i>Arkansas River:</i>						
Fort Smith, Ark. ...	22.0	1	9.0	18, 19	3.7	5.3
Little Rock, Ark. ...	23.0	1	13.4	19	6.8	6.6
<i>Missouri River:</i>						
Leavenworth, Kans. ...	20.0	20, 21	4.8	12	3.0	1.8
Kansas City, Mo. ...	21.0	24-28	5.7	6, 7, 13-16	5.1	0.6
<i>Mississippi River:</i>						
Saint Paul, Minn. ...	14.5					
La Crosse, Wis. ...	24.0					
Dubuque, Iowa ...	16.0					
Davenport, Iowa ...	15.0					
Keokuk, Iowa ...	14.0					
Saint Louis, Mo. ...	32.0	23	3.3	6, 13	6.8	2.5
Cairo, Ill. ...	32.0	19	6.7	27	2.7	4.0
Memphis, Tenn. ...	40.0	26, 27	32.7	17	13.8	18.9
Vicksburg, Miss. ...	34.0	28	25.4	19	11.0	14.4
New Orleans, La. ...	41.0	1	33.2	24	20.8	12.4
<i>Ohio River:</i>						
Pittsburgh, Pa. ....	13.0	15, 16, 17	13.4	26, 27	8.9	3.5
<i>Parkersburg, W. Va.</i>						
Pittsburgh, Pa. ....	22.0	18	18.0	16	2.9	15.1
Parkersburg, W. Va. ...	38.0	21	22.2	16	5.9	16.3
Cincinnati, Ohio ...	50.0	22	38.3	16	13.4	24.9
Louisville, Ky. ....	25.0	23	13.9	16	6.9	7.0
<i>Cumberland River:</i>						
Nashville, Tenn. ...	40.0	21	35.6	15	6.0	29.6
<i>Tennessee River:</i>						
Knoxville, Tenn. ...	29.0	19	15.0	15	1.9	13.1
Chattanooga, Tenn. ...	33.0	18	29.6	15	6.2	23.4
<i>Monongahela River:</i>						
Pittsburgh, Pa. ....	29.0	18	18.0	16	2.9	15.1
<i>Savannah River:</i>						
Augusta, Ga. ....	32.0	18	33.3	14	9.8	23.5
<i>Willamette River:</i>						
Portland, Oregon ...	15.0	23, 24	3.5	11	0.0	3.5

\* Frozen.

#### ICE IN RIVERS AND HARBORS.

The following reports relative to ice in rivers and harbors have been made by Signal Service observers:

**Thames River.**—New London, Conn.: the river froze over on the 25th, the ice being sufficiently strong to interrupt navigation. Floating ice in harbor, 26th and 27th.

**North (Hudson) River.**—New York City: floating ice in river, 10th to 15th, 25th, 26th.

**East River.**—New York City: floating ice in river, 10th, 25th.

**Monongahela River.**—Pittsburgh, Pa.: floating ice in river, 6th, 18th, 24th to 27th. The river was frozen over and navigation closed to points above Lock No. 1 on the 7th; navigation was again resumed on the 20th.

**Allegheny River.**—Pittsburgh, Pa.: ice in river, 1st to 5th, 7th to 9th, 18th, 21st, and 27th.

**Ohio River.**—Parkersburg, W. Va.: floating ice in river, 2d to 16th, 20th. Ice caused a partial suspension of navigation from the 6th to 9th.

**Saint Clair River.**—Port Huron, Mich.: the steamer "Mary," plying between this port and Marine City, Saint Clair Co., Mich., discontinued her regular trips on the 6th, this being the latest date in six years that the steamer has been compelled to lay up on account of ice; floating ice in river, 10th; the river froze for the first time this winter on the 14th.

**Mississippi River.**—Keokuk, Iowa: floating ice, 5th. River froze over for the first time this season on the 24th and 25th.

**Missouri River.**—Leavenworth, Kans.: floating ice in river, 1st, 6th, 7th, 18th to 23d. The river froze over for the first time this season on the 24th.

**Lake Michigan.**—Milwaukee, Wis.: 28th, navigation between this and the east shore ports, by the regular line steamers, has been interrupted considerably during the month by ice. Milwaukee Bay has been blocked with ice several times, and at the close of the month there were large fields of floating ice in the southern part of the lake.

#### FLOODS.

**Chattanooga, Tenn.**: the heavy rains from the 14th to 17th caused the Tennessee River to rise above the danger line on the 18th. A portion of the city was inundated and considerable damage was done to foundations of buildings, causing walls to cave in, etc. Train men reported high water and land slides along the various railroads.

**Augusta, Ga.**: the Savannah River continued to rise very rapidly during the 18th, attaining its highest point at 11 p. m. A number of streets in the lower portion of the city were submerged and all the mills were compelled to close. The river began to fall after midnight.

### ATMOSPHERIC ELECTRICITY.

#### AURORAS.

Faint auroral displays were reported as far south as Egg Harbor City, N. J. West of the Atlantic coast no auroras were reported south of the fortieth parallel. The only notable displays reported during the month are described as follows:

**Saint Vincent, Minn.**: aurora began 8.30 p. m., 26th, and ended during the night. The display was in the form of an arch; azimuth 90°; altitude 8° to 10°. Maximum brilliancy about 1 a. m., 27th. Quite a brilliant aurora began 9 p. m., 28th, and ended during the night. It was in the form of an

auroral arch, with several small needles. Maximum brilliancy about midnight, when the display extended to about 35° altitude and 140° azimuth.

Fort Buford, Dak.: an aurora was observed 10.25 p. m., 28th, consisting of an irregular arch of a pale color extending to about altitude 15°, azimuth 75°. The arch rose gradually higher, and a second and brighter arch formed at 11.08 p. m. The arch first observed had now attained about altitude 25°, and extended to about 80° azimuth; the second arch was in about the same position that the first arch occupied when first observed. Both arches were now well-defined, also the dark segment. A few streamers of a reddish tinge appeared at the extreme points of the arches. The maximum brilliancy occurred between 12.52 a. m. and 1.20 a. m., March 1st. The arches united between 1 a. m. and 1.20 a. m., the lower merging into the upper, which then changed to a straw color. The dark segment continued well-defined. Between 1.40 a. m. and 2 a. m. the arch became diffused and appeared like a bank of smoke or fog slightly illuminated; the dark segment having disappeared. At 2.30 a. m. the aurora had disappeared.

Auroras were observed during the month as follows: 1st, Egg Harbor City, N. J. 2d, Provincetown, Mass. 3d, Poplar River, Mont., and Egg Harbor City, N. J. 5th, Saint Vincent, Minn. 7th, Angelica, N. Y. 15th and 16th, Angola, Ind. 17th, Poplar River, Mont. 19th, Leech Farm, Dak. 22d, Leech Farm, Dak.; Saint Vincent, Minn.; Poplar River,

Mont. 26th, Leech Farm, Dak.; Saint Vincent, Minn.; Poplar River, Mont. 27th, Leech Farm, Dak. 28th, Kimball and Leech Farm, Dak.; Saint Vincent, Minn.; Alma, Calumet, and Sand Beach, Mich.

#### THUNDER-STORMS.

Thunder-storms were reported during the month, by states and territories, as follows: 1st and 2d, 1; 5th, 1; 7th, 2; 8th, 1; 9th, 2; 12th and 13th, 1; 15th, 7; 16th, 12; 17th, 9; 18th, 10; 19th, 3; 22d, 1; 26th, 2; 28th, 1. None were reported on the 3d, 4th, 6th, 10th, 11th, 14th, 20th, 21st, 23d to 25th, and 27th. They were reported in the greatest number of states and territories, twelve, on the 16th; in ten on the 18th; and in nine on the 17th. During this three-day period of their greatest frequency the thunder-storms were confined principally to the central and south-central states.

Thunder-storms were reported in the several states and territories, by days, as follows: Ala., 3; Dak., 1; Ga., 4; Ill., 1; Ind., 2; Iowa, 1; Kans., 2; Ky., 3; La., 2; Me., Md., and Mass., 1; Miss. and Mo., 4; Nev. and N. Mex., 1; N. C., 3; Ohio, 1; Tenn., 7; Tex., 4; Va., 2; Wash., 1; W. Va., 2; Wis., 1. In Ariz., Ark., Cal., Colo., Conn., D. C., Fla., Idaho, Ind. Ter., Mich., Minn., Mont., Nebr., N. H., N. J., N. Y., Oregon, Pa., R. I., S. C., Utah, and Wyo. no thunder-storms were reported. They were reported on the greatest number of days, 7, in Tennessee; in Georgia, Mississippi, and Missouri on 4; and in Alabama, Kentucky, and North Carolina on 3.

### MISCELLANEOUS PHENOMENA.

#### FOREST AND PRAIRIE FIRES.

Prairie fires were reported as follows: Fort Reno, Ind. T., 2d to 7th; Fort Sill, Ind. T., 2d to 7th, 9th to 16th, 18th to 22d. Forest fires were noted at Red Bluff, Cal., 4th, 21st, 28th.

#### HALOS.

Solar halos were most frequently noted in Pennsylvania, where they occurred on fourteen days. In Dak., Ill., Mass., and Tenn. they were reported on thirteen days; in New York on eleven; and in Mich., Minn., N. J., and Ohio on ten days. None were reported in Ala., Del., D. C., Ind. Ter., Ky., N. Mex., N. C., R. I., and Utah. They were noted in the greatest number of states and territories, 17, on the 21st; in 12 on the 7th; in 11 on the 13th and 24th; and in 10 on the 10th, 11th, 18th, and 20th. There were no days for which solar halos were not reported in one or more states or territories.

A display of parhelia, noted the 21st, at Spearfish, Lawrence Co., Dak., is described as follows in the "Queen City Mail," published at that place: "Parhelia, or mock suns, were observed in the morning. The display was composed of three distinct circles of rainbow-tinted light, the first encircling the sun and the others outside and crossing the first at its centre. Each ring or circle was studded with four mock suns on its rim, dividing the circle into four equal parts. The display was very brilliant and lasted over an hour."

Lunar halos were most frequently noted in California, where they were reported on twelve dates. In Missouri and Oregon they occurred on eleven dates; in Dakota and New York on ten; in Ohio and Texas on nine; and in La., Mass., Tenn., and Wash. on eight. None were reported in Conn., Del., N. Mex., R. I., Utah, and Vt. They were reported in the greatest number of states and territories, 23, on the 13th; in 18 on the 9th and 12th; in 17 on the 11th and 14th; and in 16 on the 7th. On the 27th and 28th no lunar halos were reported.

#### METEORS.

The distribution of meteors, by dates, was as follows: 1st, Villa City, Fla. 3d, Queensbury, N. Y. 7th, Lexington, Ky.; Barren Creek Springs and Fallston, Md.; Beverly, Camden, Clayton, Egg Harbor City, New Brunswick, and Somers Point, N. J.; Ardenia and Newburgh, N. Y. 14th, Ellicott City, Md.; Egg Harbor City, N. J. 15th, Limona, Fla. 17th, Villa City,

Fla. 20th, Nashua, N. H. 24th, Eden Centre, N. Y.; Westerville, Ohio. 27th, East Portland, Oregon. 28th, Santa Maria, Cal.

The following are descriptions of the more notable meteoric displays reported; those relating to meteors observed between 5 and 6 p. m. of the 7th, at stations in Maryland, New Jersey, and southern New York, being especially noteworthy:

Fallston, Harford Co., Md.: a large meteor observed in the full light of the day at 5 p. m., 7th, passing along the northern horizon towards the west.—*Report of voluntary observer.*

Egg Harbor City, N. J.: a large and bright meteor passed in a horizontal direction from east to west at 5.10 p. m., 7th; it exploded and caused a rumbling like thunder, and left a bright trail which remained in sight about five seconds.—*Report of voluntary observer.*

Beverly, Burlington Co., N. J.: a large meteor was seen in the east-northeast, altitude 45°, at 5.20 p. m., 7th, apparently moving southward. At the instant it was observed the head appeared to separate from the tail and explode, bursting into small, fiery fragments which fell toward the ground. The display lasted ten or twelve seconds; no sound was heard.—*Report of voluntary observer.*

Camden, N. J.: a meteor was seen about 5.25 p. m., 7th, going in a northwesterly direction, leaving a long trail of light. The meteor appeared to gradually diminish in size, and finally burst into two parts and vanished.—*Atlantic Review, Feb. 9th.*

New Brunswick, N. J.: about 5.30 p. m., 7th, a meteor appeared in the southwestern sky and traveled leisurely in a westerly direction until it exploded with a tremendous report that was heard not only all over this city but for miles around. Its bursting was like that of a large rocket, and was accompanied by a magnificent display of many colored lights. The observer at Princeton says: The meteor was in the west, altitude 30°, and resembled a big ball of fire going at a rapid rate and accompanied by a loud rumbling noise. It threw off a myriad of bright sparks, similar to a huge sky-rocket. In its trail was a long mass of bluish red flame. A few seconds later it burst with a loud report and display of vari-colored sparks.—*Report of New Jersey State Weather Service.*

Somers Point, Atlantic Co., N. J.: a meteor was observed at 5.35 p. m., 7th, passing from the south in a northerly direc-



tion and rapidly nearing the earth. In a few moments it exploded, separating into three fragments, one going northward, one westward, and the third northwestward. A stream of fire and smoke was observed after the explosion.—*Atlantic Review*.

Newburgh, N. Y.: a large meteor fell on a farm in Orange county on the 7th. It was very brilliant, and in color yellow tinged with green. It broke into many small pieces, and the snow, covering about an acre, was found perforated, as with gravel stones.—*The (Nashville, Tenn.) Daily American, Feb. 12th*.

Ellicott City, Howard Co., Md.: a brilliant, luminous, cylindrical body passed over this place the night of the 15th, seemingly not more than several hundred feet above the earth, and, forming a curve, appeared to descend to the ground about a mile from the village. Its course was in a northwesterly direction, and during the several seconds it was visible the vicinity was lighted as by an electric light.—*The (Baltimore) Sun, Feb. 16th*.

Limona, Hillsborough Co., Fla.: a large meteor passed from the meridian toward the southeast at 10.30 p. m., 15th. A few minutes after, and near the point where this one disappeared, another, having the appearance of burning sulphur, with falling sparks of red, white, and green colors, was seen crossing the southern sky towards the west. Some seconds later two other meteors started, from the place of the last-mentioned, and moved southeasterly.—*Reported by Mrs. G. K. Mead*.

NOTE.—The meteor noted in January, 1889, REVIEW, for Rio Grande, N. J., was observed February 12, 1889.

#### MIRAGE.

Mirage were reported as follows: Woonsocket, Dak., 7th, 23d. Hampton, Iowa, 15th. Yuma, Ariz.: a mirage was observed in the southeast just before sunrise on the 5th; distant mountains below the horizon were seen with inverted images above. A mirage was also observed in the southeast on the 7th.—*Report of Signal Service observer*.

Colegrove, Los Angeles Co., Cal.: San Nicholas Island, situated about seventy-five miles southwest of this place, and ordinarily hidden from view, was visible the afternoons of the 10th, 11th, 27th, and 28th.—*Report of voluntary observer*.

#### SAND STORMS.

Dodge City, Kans.: a very severe sand storm prevailed during the day of the 4th. The wind attained a maximum velocity of fifty-eight miles per hour at 2.15 p. m., blowing down chimneys and out-houses.—*Report of Signal Service observer*. Yuma, Ariz.: a violent sand storm prevailed during the afternoon of the 14th; maximum velocity of wind forty-six miles per hour.—*Report of Signal Service observer*. Sand

storms also occurred at Fort Bowie, Ariz., 13th, and Willcox, Ariz., 14th and 15th.

#### SUN SPOTS.

Haverford College Observatory, Pa. (observed by Mr. H. V. Gummere):

Date. February, 1889.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculae.	Remarks.	
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.			
1, 10 a. m. . .	1	6	0	0	0	0	1	6	1	8	Definition good; count of faculae stopped by clouds.
7, 10 a. m. . .	0	0	0	0	0	0	0	0	4	4	Definition good.
9, 11 a. m. . .	0	0	0	0	0	0	0	0	15	59	Definition very good.
12, 10 a. m. . .	0	0	0	0	0	0	0	0	4	13	Definition good.
13, 11 a. m. . .	0	0	0	0	0	0	0	0	4	11	Definition good.
14, 11 a. m. . .	0	0	0	0	0	0	0	0	5	5	Definition poor.
20, 11 a. m. . .	0	0	0	0	0	0	0	0	5	16	Definition good.
21, 12 m. . . .	0	0	0	0	0	0	0	0	5	5	Definition poor.
25, 10 a. m. . .	0	0	0	0	0	0	0	0	1	1	Definition poor.
26, 11 a. m. . .	1	14	0	0	0	0	1	14	4	12	Definition good.

Mr. John W. James, Riley, McHenry Co., Ill.: the only ones seen were two small spots, half way from east edge to sun's meridian, on the 2d; these had vanished by the 5th; and a group of six small spots, two days west of meridian, on the 28th. Mr. H. D. Govey, North Lewisburgh, Champaign Co., Ohio: sun-spots were observed on the 1st and 28th.

#### VERIFICATIONS.

Owing to an interruption of work, due to a change in the location of this office, the percentages of the official indications of the Signal Service for February, 1889, were not completed in time to be published in this issue of the REVIEW. They will be published in the next number.

Percentages of local verifications of weather and temperature signals as reported by directors of the various State Weather Services for February, 1889.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois . . . . .	83.2	80.1	New Jersey . . . . .	76.0	62.7
Indiana . . . . .	87.7	85.7	New York . . . . .	78.0	80.0
Kansas . . . . .	84.8	80.7	North Carolina . . . . .	79.8	72.5
Louisiana (northern) . . . . .	80.0	82.0	Ohio . . . . .	89.0	85.0
Louisiana (southern) . . . . .	74.0	83.0	South Carolina . . . . .	81.0	83.5
Michigan . . . . .	82.9	81.1	Tennessee . . . . .	84.5	77.6
Minnesota . . . . .	87.0	80.0	Texas . . . . .	87.0	86.0
Nebraska . . . . .	82.2	85.0			

#### STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for February, 1889, of the directors of the various state weather services:

##### ALABAMA.

The month has been colder than usual in all portions of the state, and the average temperature was 2.9 below the normal. The coldest day was the 7th, and the warmest period was the 16th and 17th. The warm wave crossed the northern part of the state on the 16th and was felt in south Alabama on the 17th. The close of the month moderated sufficiently to cause the buds of fruit trees to open rapidly.

There was a deficiency of rain at a majority of the stations and the average precipitation was 0.5 below the normal. The fall of snow that occurred on the 21st was large for this climate, but on account of the shallow depth, 2 inches, it remained on the ground only a few hours.

The weather has been generally favorable for farming operations, and the farmers have made satisfactory progress in placing the seed in the ground.

##### Summary.

Temperature.—Monthly mean, 46.3; highest monthly mean, 50.6, at Tuscaloosa; lowest monthly mean, 39.3, at Valley Head; maximum, 80, at Montgomery, 17th; minimum, 7, at Valley Head, 7th; range for state, 73; greatest local monthly range, 62 at Motes; least local monthly range, 41 at Mobile.

Precipitation.—Average for the state, 4.29; greatest, 7.14, at Valley Head; least, 2.00, at Greensborough.

Wind.—Prevailing direction, northwest.—*P. H. Mell, Signal Corps, Auburn, director*.

##### ARKANSAS.

##### Summary.

Temperature.—Monthly mean, 43.1; highest monthly mean, 49.9, at Texarkana; lowest monthly mean, 36.7, at Lead Hill; maximum, 85, at Texarkana, 16th; minimum, 4, at Eureka Springs, 6th; range for state, 81; greatest local monthly range, 72, at Eureka Springs; least local monthly range, 38, at Dallas.

Precipitation.—Average for the state, 2.53; greatest, 5.80, at El Dorado; least, 1.02, at Heber.—*Prof. John C. Branner, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant*.

##### ILLINOIS.

Temperature.—Mean of the northern division, 20; of the central division, 26; of the southern division, 31; maximum for northern division, 64, at

Charleston, 16th; for central division, 66, at Pana, 16th; for southern division, 78, at Makanda, 16th; minimum for northern division, -16, at Cedarville and Winnebago, 23d; for central division, -10, at Pekin and Atwood, 20th; for southern division, -1, at Greenville, Collinsville, and Benton, 23d.

**Precipitation.**—Average for the northern division, 1.31; for the central division, 1.68; for the southern division, 2.42; greatest in northern division, 2.82, at Dwight; in central division, 2.40, at Griggsville; in southern division, 4.87, at Collinsville; least in northern division, 0.61, at Lacon; in central division, 0.59, at Mattoon; in southern division, 1.15, at Golconda.—*John Craig, Sergeant, Signal Corps, Springfield, in charge.*

#### INDIANA.

February was a cold month; its mean temperature was nearly 7 below the normal for eighteen years, and about 2 below the normal for seven years. The steady cold temperature prevailing was only interrupted by abnormally high temperatures on the 4th and 16th. Very low temperature did not occur; in the southern portion of the state it barely reached zero, while in the central and northern portions the temperature fell only a few degrees below zero.

The precipitation, mostly in the form of snow, was very small and at many stations more than 2.00 inches below the normal. The smallest amount was measured in the central portion. The snowfall was least in the southern portion, and most in the northern, but rapidly disappeared after it had fallen.

#### Summary.

**Temperature.**—Monthly mean, 26.6; highest monthly mean, 34.9, at Marengo; lowest monthly mean, 20.4, at Angola; maximum, 71.0, at Vevay, 16th; minimum, -10.0, at Angola, 25th; range for state, 60.2; greatest local monthly range, 68.0, at Rockville; least local monthly range, 56.0, at Columbia City.

**Precipitation.**—Average for the state, 1.51; greatest, 3.62, at Marengo; least, 0.74, at Farmland.

**Wind.**—Prevailing directions, northwest and west.—*Prof. H. A. Huston, La Fayette, director; C. P. R. Wappenhans, Sergeant, Signal Corps, assistant.*

#### IOWA.

The month was cold, fair, and dry, northwesterly winds largely prevailing. The mean temperature was 3.7 below normal. The coldest days were the 22d and 23d, being 31 below normal. These were the only days of the entire winter on which the temperature remained below zero at noon at central station. The warmest days were the 2d, 3d, 14th, and 15th, averaging 12 above normal. The total number of very cold days on which the temperature fell to or below zero was five; the six preceding Februaries averaged eight very cold days each.

Snowfall was frequent, but very light, and rain fell only on the 4th, and from the 14th to 16th. While precipitation fell in Iowa on twenty days, it was general only on the 15th and 16th, mainly as rain; this also constituted the most abundant precipitation of the month. The total amount of precipitation exceeded one inch only in the extreme southeast and east of the state. It was less than a quarter of an inch in the western half. It averaged less than half an inch for the state.—*Dr. Gustavus Hinrichs, Iowa City, director.*

#### KANSAS.

The first half of the month was warm, being a continuation of the January weather, while during the last half the state was given a touch of genuine winter. In the eastern division the temperature ranged about 5 below the normal; in the middle it was slightly above, while in the western it fell decidedly below the normal.

Nearly all the precipitation was in the form of snow; it was heaviest in the eastern counties, Johnson and Miami receiving three inches and over; it was least in the counties south of the Arkansas and north of the Solomon rivers, while nearly an average precipitation occurred in the belt of counties extending from Greeley and Hamilton to Republic and Washington.

#### Summary.

**Temperature.**—Monthly mean, 27.4; highest monthly mean, 34.5, at Rome; lowest monthly mean, 19.8, at Tribune; maximum, 78, at Rome, 15th; minimum, -17, at McAllister, 20th; range for state, 95; greatest local monthly range, 84, at Rome; least local monthly range, 55, at Belleville; greatest daily range, 39, at Lebo, 2d and 14th; least daily range, 0, 28th, at Morse.

**Precipitation.**—Average for the state, 0.73; greatest, 3.05, at Morse; least, 0.04, at Englewood.

**Wind.**—Prevailing direction, north.—*Prof. J. T. Lovewell, Topeka, director; T. B. Jennings, Sergeant Signal Corps, assistant.*

#### KENTUCKY.

#### Summary.

**Temperature.**—The average temperature for the state during the month, as determined from the tri-daily observations, was 34.1; from the mean of the maximum and minimum, 34.3. These figures indicate a temperature of 5 less than the normal for the month. This deficiency is more than sufficient to neutralize the excess which existed January 31st. The mean daily maximum temperature was 43.6, and the mean daily minimum, 25. The highest temperature recorded in the state was 72, at Shelbyville, 16th, and the lowest, 4, at Ashland, 13th. The month was remarkable for the extreme monthly ranges of temperature reported; the state average being 59.7; the greatest, 66, at Shelbyville, and the least, 53, at Franklin. The 16th was in all sections of the state the warmest day, and the 6th, 7th, 13th, and 23d the coldest. At

the central station the average for the winter was 36.3, which is less than 1 below the normal.

**Precipitation.**—The average precipitation for February was 1.91, which is 2.50 less than the normal. The greatest amount of precipitation, 2.94, was reported from Shelbyville, and the least, 0.88, at Mount Sterling. The snowfall was much less than usual, the amount being insufficient, as a rule, to cover the ground for any length of time. The average number of rainy days was 6; cloudy, 15; fair, 6, and clear, 7.

**Wind.**—Prevailing direction, west.—*Dr. E. A. Grant, Louisville, director; Frank Burke, Sergeant, Signal Corps, assistant.*

#### LOUISIANA.

The remarkable features of the month were the great number of cloudy days and the lack of rainfall. The month can be considered the coolest and cloudiest February in past twenty years. The average rainfall for the northern section was but 1.08, a deficiency of 4.00 as compared with normal of past twenty years, and is the lowest average February rainfall in that period. The southern section received an average of 2.56, which is a deficiency of nearly 1.50 from the February normal for that section, making the deficiency for the state at large about 2.50. The greatest average rainfall was 6.63, in 1882, the least, 1.59, in 1871.

The average temperature for the state, 51.3, was 3 below the normal for the month. The deficiency in temperature was slightly greater in the southern section. There is a difference of nearly 6 between the normals for the northern and southern sections, the former being about 52, and the latter about 58. The coolest February on record was in 1885, when the average temperature was below 48; the warmest, 1887, when the average temperature reached 62.

Frost occurred on an average of five days in the northern section, and on two days in the extreme southern section.—*R. E. Kerkam, Sergeant, Signal Corps, New Orleans, in charge.*

#### MICHIGAN.

#### Summary.

**Temperature.**—The mean temperature, 16.1, is 7.0 below the normal of fourteen years. The temperature is below the normal in all sections, and the deficiencies ranged from 1.6 to 7.9. The temperature was above the normal on six days, normal on one, and below the normal on twenty-one days. The highest mean daily temperature, 34, occurred on the 16th, when the temperature was 8 above the normal, and the lowest on the 23d, -7, when the temperature was 13 below the normal. The highest mean daily temperature in the past fourteen Februaries, 49, occurred in 1882, and the lowest, -7, on the 10th and 11th, 1886, and on the 23d, 1889. The highest mean monthly temperature, 33.4, occurred in 1882, and the lowest, 10.2, in 1885. This record, 10.2, is the only one in the past 13 Februaries that is lower than the record for 1889, 16.1. The maximum temperature for the month, 55, occurred on the 16th, and the lowest, -33, was recorded on the 23d and 24th, at two stations.

**Precipitation.** The average precipitation, 1.69, is 1.19 below the normal of fourteen years. The precipitation was below the normal in the southern peninsula and above the normal in the upper peninsula. The greatest amount of precipitation, 4.07, was recorded at Weldon Creek, Mason Co., and the least, 0.57, at Mio, Oscoda Co. Precipitation was general on the 4th, 5th, 8th to 11th, 16th, 17th, 18th, and 26th. Seven stations report one inch or more of precipitation in 24 hours; the largest amount in 24 hours, 1.43, was recorded at Northport on the 16th. The greatest amount of precipitation in the past 14 Februaries, 4.69, was recorded in 1881, and the least, 0.05, in 1877. Rain was recorded on the 4th and 16th, on all other dates the precipitation fell as snow, which, in most cases, was light and dry.

**Wind.**—Prevailing direction, northwest.—*N. B. Conger, Sergeant, Signal Corps, Lansing, director.*

#### MINNESOTA.

February was remarkable for being the coldest month of the winter season; the lowest monthly temperature is usually recorded for January in Minnesota. The precipitation (snow) was nearly the average amount, and it fell principally from the 3d to the 16th, and on the 21st and 24th.

#### Summary.

**Temperature.**—The mean temperature, 7.7, is about 6 below the February normal of 16 years. The 23d was the coldest day of the month throughout the state, and all observers noted the highest temperature on the 28th. Range for the state, 97.5, the minimum being -44.5, at Grand Forks, Dak., 23d, and the maximum, 53, at Duluth, 28th.

**Precipitation.**—The average precipitation, 0.87, is about normal. The total monthly snowfall varied from 3 at Medford to 17 at Leech Lake Dam, the average fall over the state being 9. The depth of unmelted snow remaining on the ground at the end of the month was from 7 to 11 in the northern half of the state, and from 0 to 5 in the southern part.

**Wind.**—Prevailing direction, northwest.—*Prof. W. W. Payne, Northfield, director; John Healy, Private, Signal Corps, Saint Paul, assistant.*

#### MISSISSIPPI.

#### Summary.

**Temperature.**—The mean temperature of the state for the month, 46.3, is 4.2 less than the normal; highest local monthly mean, 53, at Logtown; lowest, 38.9, at Pontotoc; maximum, 81, at Water Valley, Louisville, and Greenville, 16th; minimum, 15, at A. and M. College, 7th, and at Batesville, 24th; the daily range at most stations varied in value from 12 to 28, except on the 5th, 10th and 15th, when it was less than 10.



**Precipitation.**—The average precipitation, 2.46, is 2.85 less than the normal for February. The rainfall was very unevenly distributed as to localities, and nearly all of it fell between the 14th and 18th. A fall of from 1.50 to 2.00 in twenty-four hours was reported on the 16th from Greenville, Batesville, Water Valley, University, Rienzi, and A. and M. College. A marked deficiency in quantity is especially shown in the central and southwestern parts of the state. Barely enough snow to cover the ground fell in the northern part of the state on the 6th.

**Wind.**—Prevailing directions, south and southeast.—*R. B. Fulton, Signal Corps, University, director.*

## MISSOURI.

## Summary.

**Temperature.**—The mean temperature for February was 29.5. The highest temperature reported in the state was 73 at Steelville and Glasgow, and the lowest, —9, at Mound City. The average of maximum temperatures was 66.8, and the average of minimum temperatures, —2.6, making an average range of 69.4. The highest temperatures occurred on the 4th, 15th, and 16th, and the lowest on the 6th, 19th, and 23d.

**Precipitation.**—The average precipitation was 2.60, which was 0.23 below the February normal. The greatest amount of precipitation reported was 5.97, at the central station, and the least was 0.54 at Langdon. In the state, as a whole, precipitation occurred on 22 days. The greatest number of days of precipitation at any one place was 13, at Fox Creek.—*Prof. Francis E. Nipher, Saint Louis, director; G. A. Weber, Sergeant, Signal Corps, assistant.*

## NEBRASKA.

The month has been prevailing warm and dry, although two distinct cold waves, one from the 4th to the 6th and the other from the 21st to the 23d, brought the mean temperature down to about normal. The precipitation has been less than for any year, except 1878 and 1880.

**Temperature.**—The mean for the month was 22.8. February has an extremely variable mean temperature, being sometimes as high as 35 and sometimes as low as 10. There have been the normal number of freezing days, but rather less than usual below zero. The minimum for the month was —27, in the northern part of the state, which is the lowest February minimum recorded.

**Precipitation.**—Only one station, Falls City, in the extreme southeastern part of the state, reports 1.00, and only two others report over 0.50, Tecumseh, in the southeastern part, and Hay Springs, in the far northwest. The number of cloudy days was about normal and the number of rainy days a little below normal.—*Prof. Goodwin D. Swezey, Crete, director; G. A. Loveland, Corporal, Signal Corps, assistant.*

## NEW ENGLAND METEOROLOGICAL SOCIETY.

## Summary.

**Temperature.**—Monthly mean, 22.0 (105 stations); highest monthly mean, 29.6, at Nantucket; lowest monthly mean, 11.8, at West Milan; maximum, 58, at Westborough, 9th; minimum, —38, at Berlin Mills, 3d; range for New England, 96; greatest local monthly range, 90, at West Milan; least local monthly range, 44, at Brewster; greatest daily range, 54, at Berlin Mills, 22d; least daily range, 1, at Woonsocket, 8th. The average temperature in February of 27 stations, having records for more than 10 years, is 24.9; the departure for February, 1889, is —2.7.

**Precipitation.**—Average for New England, 2.32 (124 stations); greatest, 5.20, at Orono; least, 0.77, at Stratford. The average precipitation in February of 35 stations, having records for more than 10 years, is 3.72; the average for February, 1889, is 2.28; departure, —1.44.

**Wind.**—Prevailing direction, northwest (18 stations).—*Prof. William H. Niles, Boston, Mass., president; Prof. Winslow Upton, Providence, R. I., secretary; Park Morrill, Sergeant, Signal Corps, assistant.*

## NEW JERSEY.

The mean temperature for February, 1889, is 3.8 below the average determined from past records of 50 stations, and 2.9 below the average for the corresponding month of 1888. The warmest days during the month were the 5th, 9th, 15th, 17th, 18th, and 19th, and the coldest the 4th, 23d, and 24th. The lowest temperature recorded in the northern portion of the state was 0; in the central, —3, and in the southern, 5. The mean temperature of the winter season just closed, 32.9, is 2.6 above the winters of 1887 and 1888, and 1.7 above the winter normal.

## Summary.

**Temperature.**—Monthly mean, 27.7; highest monthly mean, 32.9, at Bridgeton; lowest monthly mean, 25.1, at Madison; maximum, 57, at Plainfield, 19th; minimum, 3, at Locktown, 24th; range for state, 60; greatest local monthly range, 58, at Plainfield; least local monthly range, 42, at Billingsport and New Brunswick; greatest daily range, 34, at Allaire, 5th; least daily range, 0, at Union, 18th.

**Precipitation.**—Average for the state, 2.49; greatest, 3.80, at Ocean City; least, 1.65, at Hopewell.

**Wind.**—Prevailing directions, northwest and west.—*Prof. George H. Cook, New Brunswick, director; E. W. McGann, Sergeant, Signal Corps, assistant.*

## NEVADA.

**Temperature.**—Reports received from 23 stations show that the mean for the state, 33.6, was slightly below the average, 36.4. El Dorado Canyon, Lincoln Co., reported a maximum of 75.2 on the 28th, the minimum, —11, occurred at Elko on the 1st, making the absolute range for the state, 86.2. It

was coldest in the northern part of Eureka county, in the vicinity of Beowawe, and was warmest in the southern part of Lincoln county, around El Dorado Canyon; the mean monthly temperature at the latter place being 55.2.

**Precipitation.**—(12 stations: 6 in the extreme western and 6 in the north-eastern and eastern portions of the state.) Average for the state, 0.37, a little more than half the average for the same month last year. The largest amount at a single station in any 24 consecutive hours was 0.64, at Ely, 15th. Pioche reported the largest monthly rain and snowfall, 0.79. Although 26 inches of snow fell in the southern part of Elko county and 12 inches in the northeastern part of Lincoln county, yet Pioche is the only station at which snow was reported as being on ground on last day of the month.—*Prof. Chas. W. Friend, Carson City, director; H. F. Alciatore, Private, Signal Corps, assistant.*

## NEW YORK.

## Summary.

**Temperature.**—The highest temperature was 54, at Setauket, L. I., 5th, and at Erie, Pa., 16th; the lowest, —35, at Canton, 4th. The mean temperature for the state was 18.5; the 17th was the warmest, and the 23d the coldest day. The temperature was below the normal at all stations, except Palermo and Setauket, where it was about 1 above.

**Precipitation.**—Average for the state, 2.26. The amount was below the average at all stations, except Angelica, where it was 0.54 above; at Potsdam, 3.10 above; Utica, 2.31 above, and at Palermo, normal. The greatest daily rainfall was 1.50, at Ardenia, 18th. The average number of days on which the precipitation was 0.01 or more was 12.

**Wind.**—Prevailing direction, west.—*Prof. E. A. Fuertes, Ithaca, director; I. W. Brewer, Private, Signal Corps, assistant.*

## NORTH CAROLINA.

## Summary.

**Temperature.**—Monthly mean, 39.4; highest monthly mean, 43, at Southern Pines; lowest monthly mean, 36.7, at Mount Pleasant; maximum, 72, at Southern Pines, 18th; minimum, 8, at Lenoir; mean monthly range, 52.4.

**Precipitation.**—Average for the state, 3.84; greatest, 6.66, at Statesville; least, 1.95, at Wake Forest.

**Wind.**—Prevailing directions, northeast and west.—*Dr. Herbert B. Battle, Raleigh, director; H. McP. Baldwin, Sergeant, Signal Corps, assistant.*

## OHIO.

## Summary.

**Temperature.**—The mean temperature of the northern section was 22.5; the middle section, 25.4; the southern section, 29.9; and the state, 25.8. These means are 3.3, 2.2, 2.7, and 3.0 below the means for the sections and state, respectively. The highest temperature reported during the month was 69.8, at Cincinnati, 16th, and the lowest —13.5, at Jefferson, 24th. The mean daily range of temperature was 17.5; the maximum range being 43, at Wauseon, 21st, and the minimum, 2.0, at Toledo, 5th. It was the coldest February since 1885, in which year the mean temperature of February was 19.3.

**Precipitation.**—The precipitation was general, mostly in the form of snow, on the 8th, 11th, 16th, 17th, and 18th. Light local rain or snow occurred in all sections on the 3d, 4th, and 13th; in the northern section on the 7th, 12th, 22d, and 26th; in the middle section on the 6th, 9th, 15th, and 26th; and in the southern section on the 12th, 15th, and 27th. The mean for the state, 1.35, is 2.29 below the average, and is the smallest rainfall on record for February. The greatest monthly rainfall was 2.44, at Marietta; least, 0.47, at Youngstown.

**Wind.**—Prevailing direction, west.—*Prof. B. F. Thomas, Columbus, director; Lieut. Charles E. Kilbourne, secretary; C. M. Strong, Private, Signal Corps, assistant.*

## PENNSYLVANIA.

## Summary.

**Temperature.**—The mean temperature, obtained from the daily observations of 46 stations, was 23, which is 6 below the normal. The mean daily maximum and minimum temperatures, 31.3 and 14.8, respectively, give a monthly mean of 23. Uniontown reports an average daily temperature of 30, and Eagle's Mere, 12; which are the two extremes. The highest temperatures reported were: Indiana, 60; Uniontown, 58; McConnellsburgh and Philipsburgh, 56; the lowest, Coudersport and Smethport, —27; Columbus, —26; Grampian Hills and Clarion, —21. The low temperatures occurred the 24th.

**Precipitation.**—Average for the state, 1.96, which is 1.25 less than the normal. The precipitation was evenly distributed throughout the state, and at quite regular intervals during the month. Snows were numerous, but soon melted in the agricultural districts. The greatest snowfalls for the month were: Eagle's Mere, 28; Smethport, 20; Philipsburgh and Wellsborough, 18; Coudersport and Grampian Hills, 17. No heavy drifts occurred.

**Wind.**—Prevailing direction, west.—*Under direction of the Franklin Institute, Philadelphia; T. F. Townsend, Sergeant, Signal Corps, assistant, in charge.*

## SOUTH CAROLINA.

## Summary.

**Temperature.**—The mean for the month was 41.9, being 8 lower than the record for February, 1888; the maximum occurred on the 17th and 18th, and the minimum on the 7th; highest monthly mean, 46, at Charleston; lowest monthly mean, 35.5, at Evergreen; maximum, 75, at Aiken, 17th; minimum, 10, at Evergreen and Winnsborough, 7th; range for state, 65.

**Precipitation.**—Mean depth of rainfall, 5.60; greatest monthly rainfall,

7.33, at Timmonsville; least monthly rainfall, 3.67, at Clinton; greatest daily rainfall, 2.82, at Belmont, 17th; average number of rainy days, 7.7.

Wind.—Prevailing directions, northwest and west.—Hon. A. P. Butler, Columbia, director; H. C. Seymour, Private, Signal Corps, assistant.

#### TENNESSEE.

The principal features of the month were the thunder-storms of the 16-17th, which prevailed with greater or less severity over the entire state, and the small amount of precipitation. Altogether, the month was not an unfavorable one for the farmer. The mean temperature was a little below the average for the past six years. The average precipitation, 2.83, was 2.00 less than the mean for February during the past six years; of this amount the eastern division received an average of about 4.00, the middle division nearly 2.75, and the western division about 1.75. By far the greatest proportion of the amount fell from the 15th to the 18th, inclusive. The greatest rainfall occurred on the night of the 16th and morning of the 17th, and at many stations more than 2.00 were reported. Snow fell at the various stations on fifteen days, most of it, however, was light and unmeasurable.

#### Summary.

Temperature.—Monthly mean, 38.2; highest monthly mean, 51.6, at Savannah; lowest monthly mean, 34.5, at Riddleton; maximum, 74, at McKenzie, 16th; minimum, 5, at Cog Hill, 7th; range for state, 69; greatest local monthly range, 67, at Cog Hill and Hohenwald; least local monthly range, 51, at Andersonville; greatest daily range, 39, at Kingston Springs, 4th, 22d, and at Hohenwald, 22d; least daily range, 3.5, at Clarksville, 17th.

Precipitation.—Average for the state, 2.83; greatest, 5.82, at Knoxville; least, 1.31, at Clarksville and Milan.

Wind.—Prevailing direction, northwest.—J. D. Plunket, M. D., Nashville, director; H. C. Bate, Signal Corps, assistant.

#### TEXAS.

The month was not marked by any extraordinary departures from the normal. It was somewhat colder than usual, with comparatively little precipitation, except during the last two days. In the southern counties and Brazos Valley cloudy and rainy days were largely in excess of the number reported from other portions of the state, but the precipitation was not in excess of the normal. On the whole the weather was favorable for farm work and seeding.

#### Summary.

Temperature.—The mean temperature for the month, 49.7, is considerably below the normal for February. The warm period occurred about the 16th, and the cold period between the 18th and 25th. The average temperature for the coast and southern counties was 57.1; the maximum for the state, 92, occurred on the 16th at Rio Grande City; the minimum, 1, on the 23d at Fort Elliott; range for state, 91; greatest local monthly range, 74, at Fort Elliott; least local monthly range, 34, at Corpus Christi.

Precipitation.—Average for the state, 2.96; greatest, 5.02, at Austin; least, 0.18, at El Paso.

Wind.—Prevailing direction, northwest.—S. O. Young, M. D., Galveston, director; Allen Buell, Sergeant, Signal Corps, assistant.

Meteorological record of voluntary observers and Army post surgeons, February, 1880.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<b>Alabama.</b>					<b>Arizona—Cont'd.</b>				
Auburn	75	16	46.3	5.72	Holbrook	61	10	36.4	0.39
Birmingham	78	20	47.5	4.91	Mariopu	70	40	56.0	0.15
Butler	75	9	48.0	1.73	Mount Huachuca	70	22	41.4	0.05
Citronelle	75	22	51.0	3.34	Pantano	62	29	42.3	0.05
Decatur	75	22	48.0	4.35	Peoria	71	27	51.6	0.24
Elkton	75	22	42.8	6.10	Prescott Junction	60	11	28.9	0.00
Florence	72	18	43.0	4.37	San Carlos	75	25	47.0	1.00
Gadsden	70	13	42.9	6.39	San Simon	75	25	47.0	0.80
Greensborough	50	20	47.8	3.06	Teviston	75	25	47.0	0.80
Livingston	79	20	47.4	2.41	Texas Hill	75	39	57.2	0.00
Motest	73	11	45.2	6.72	Tucson (1)	82	29	55.0	1.06
Mt. Vernon B'ks.	70	22	50.0	3.62	Tucson (2)	69	39	54.7	1.50
New Market	78	9	40.6	3.99	Whipple Barracks	59	1	34.5	0.22
Talladega	76	15	47.1	4.90	Wilcox	72	29	50.3	1.70
Froy	75	14	45.6	3.30	Williams	48	20	19.1	0.60
Tuscaloosa	75	14	50.6	3.39	Winslow	75	14	39.9	1.40
Tuscumbia	74	15	41.1	4.50	Arkansas—Cont'd.				
Union Springs	77	30	48.2	3.62	Alexander	75	14	39.9	2.33
Uniontown	79	24	49.2	2.06	Arkansas City	71	23	46.4	1.53
Valley Head	68	7	39.2	7.14	Camden	71	23	46.4	1.53
<b>Alaska.</b>					Conway	74	19	42.4	2.05
Killisnoo	45	11	31.5	3.35	Dardanelle	69	31	43.0	2.10
<b>Arizona.</b>					Dallas	66	23	42.4	3.20
Antelope Valley	69	24	48.4	0.64	Dayton	72	19	43.9	5.80
Benson	72	40	55.5	0.00	El Dorado	76	4	36.2	4.70
Casa Grande	72	40	55.5	0.00	Eureka Springs	76	4	36.2	4.70
Cedar Springs	66	30	44.3	1.80	Forrest City	78	19	47.0	5.05
Eagle Pass	66	30	44.3	1.80	Fulton	73	30	45.9	3.43
Florence	73	23	51.6	0.84	Galveston	73	30	45.9	3.43
Fort Apache	60	3	36.6	0.69	Heber	74	12	44.9	1.02
Fort Bowie	50	14	42.6	1.47	Helena (1)	77	15	43.9	2.00
Fort Huachuca	69	31	42.9	1.35	Helena (2)	75	14	43.2	2.99
Fort Lowell	80	36	51.9	0.53	Lead Hill	72	10	36.7	2.87
Fort McDowell	74	36	52.0	0.35	Little Rock B'ks.	76	17	43.6	1.75
Fort Mojave	71	14	42.4	0.25	Lonoke	76	19	46.1	1.75
Fort Verde	69	11	31.5	3.35	Madison	75	32	54.3	0.37
Globe	69	11	31.5	3.35					

#### Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Arkansas—Cont'd.	°	°	°	Ins.	California—Cont'd.	°	°	°	Ins.
Newport †	63	11	39.2	1.15	Norwalk	80	28	53.6	1.19
Ozone †	78	11	41.2	3.31	Oakland	64	35	49.7	0.70
Portia †	78	11	41.2	1.90	Ontario	84	32	55.1	1.05
Russellville	75	17	41.6	1.30	Oroville	76	35	52.0	0.57
Stuttgart †	78	16	42.1	2.39	Pajaro	84	23	51.7	0.70
Texarkana	85	22	49.9	1.14	Paso Robles	69	22	46.1	0.98
Washington †	78	20	45.9	3.25	Petaluma	74	25	50.1	0.72
British Columbia.					Placerville	72	25	45.6	0.35
New Westminster.	54	25	40.1	4.21	Pomona	80	34	60.6	5.12
California.					Porterville	77	27	50.1	0.18
Alcade	70	29	48.4	0.40	Presidio of San F	70	31	50.4	0.75
Alcatraz Island	70	38	52.4	0.50	Puente	81	28	53.9	0.94
Almaden	74	33	53.1	0.69	Red Bluff	90	32	53.8	0.57
Anaheim	80	36	61.3	1.28	Redding	77	30	53.3	0.09
Anderson	82	27	53.6	1.72	Rocklin	75	30	49.8	0.03
Angel Island	82	30	57.0	0.91	Rumsey	68	30	48.9	0.00
Antioch	67	30	48.6	0.52	Sacramento (1)	73	23	44.9	0.42
Aptos	76	32	51.6	0.87	Sacramento (2)	70	32	45.1	0.25
Athlone	80	26	50.9	0.39	Salinas (1)	76	30	47.8	1.64
Auburn	76	32	49.7	0.52	Salinas (2)	80	30	52.5	1.65
Bakersfield	78	28	52.0	0.20	Salton	90	49	55.4	5.12
Banning	80	24	53.7	2.01	Sanger Junction	76	25	51.1	0.54
Barstow	74	22	49.6	0.04	San Bernardino	82	34	57.5	1.50
Beaumont	70	30	51.4	1.95	San Ardo	72	28	48.9	0.80
Benicia Barracks	77	28	51.5	0.34	San Diego B'ks	81	37	56.0	1.25
Bishop Creek	74	19	47.3	?	San Fernando	78	32	55.2	0.63
Boca	60	12	31.3	?	San Gabriel	80	30	54.2	1.12
Borden	60	30	49.4	0.44	San Jose	71	32	50.9	0.70
Boulder Creek	77	24	46.7	1.80	San Mateo	70	32	49.1	0.75
Brentwood	79	26	52.9	0.72	San Miguel	75	23	49.6	0.85
Brighton	80	32	51.1	0.46	San Pedro	78	45	57.5	0.86
Byron	68	26	50.9	0.72	Santa Ana	85	32	58.5	2.07
Cactus	89	39	63.4	0.00	Santa Barbara (1)	80	35	55.4	1.29
Caliente	73	32	49.6	0.20	Santa Barbara (2)	80	34	56.8	1.38
Calistoga	85	21	51.5	0.72	Santa Cruz	73	35	52.9	1.37
Castroville	74	32	50.6	1.59	Santa Margarita	72	19	51.8	0.11
Chico	75	27	51.4	0.50	Santa Maria	83	28	51.8	1.35
Cisco	55	3	37.4	1.10	Santa Monica	80	40	52.5	1.03
Colegrove	66	17	40.1	0.15	Santa Paula	80	38	57.7	1.02
Coles	76	22	47.4	0.90	Santa Rosa	72	25	48.6	0.35
Colfax	76	22	47.4	0.90	Selma	76	30	49.0	0.53
Colton	84	22	57.4	0.88	Seven Palms	82	37	60.1	0.06
Corning	60	30	46.1	0.76	Soledad	80	26	48.1	1.75
Davisville	72	27	52.5	0.41	Soquel	76	30	51.9	0.00
Delano	80	25	51.8	0.05	South Side	70	26	49.7	0.42
Delta	79	24	51.2	1.02	South Vallejo	68	32	51.0	0.66
Downey	80	29	54.3	0.73	Spadra	84	31	51.9	0.00
Dunnigan	70	29	50.3	0.60	Stockton	64	34	49.2	0.87
Dunsmuir	72	30	47.4	0.33	Summit	45	1	30.1	0.00
El Dorado	74	27	48.5	0.38	Suisun	80	32	51.9	0.85
Elmira	100	28	55.0	0.88	Susana	58	7	36.6	0.60
El Verano	78	26	50.6	0.68	Tehachapi	65	18	38.5	0.00
Emigrant Gap	68	10	40.6	0.00	Tehama	70	36	51.7	0.30
Esperanza	66	30	44.4	0.78	Templeton	73	23	45.3	1.20
Farmington	71	28	49.1	0.70	Towles	72	12	46.4	0.00
Felton	80	24	51.3	1.98	Tracy	60	29	38.6	0.55
Florence	86	40	57.5	0.79	Traver	69	24	48.8	0.33
Folsom	76	32	50.6	0.57	Tropico	83	26	51.3	0.00
Fort Bidwell	60	10	35.7	0.20	Truckee	54	8	31.5	0.00
Fort Gaston	67	13	41.5	2.32	Tulare	77	30	52.4	0.19
Fort Mason	67	37	52.0	0.76	Turlock	74	30	51.4	0.33
Fruto	80	38	52.0	1.42	Vacaville	74	32	50.1	0.90
Galt	68	29	50.7	0.48	Valley Springs	71	30	48.0	0.91
Georgetown	24	24	24.0	0.68	Vina	75	29	49.1	0.29
Gilroy	82	28	49.5	1.00	Volcano Springs	86	35	57.9	0.00
Glen Ellen	78	24	45.7	0.97	Westley	72	32	51.8	0.33
Goshen	74	23	53.2	0.22	Whittier	86	40	59.8	0.28
Hanford	71	27	48.0	0.35	Williams	64	30	48.6	0.50
Hollister	78	29	48.1	0.87	Willow (1)	71	21	48.1	0.70
Hornbrook	70	10	40.3	0.00	Willow (2)	62	30	47.6	0.66
Hydesville †	66	26	47.2	2.31	Winters	77	30	53.8	0.50
Indio	87	32	56.8	0.00	Woodland	70	30	46.5	0.55
Ion	68	28	46.4	0.30	Colorado.				
Keeler	71	24	47.9	0.00	Aspen	60	18	38.5	1.25
Keene	72	20	45.0	0.00	Bennett	60	10	26.0	0.40
Kingsburg	72	32	49.7	0.35	Breckenridge	61	23	38.5	0.00
Kings City	80	25	45.4	1.33	Canon City	67	1	35.1	1.74
Knight's Landing	75	35	47.0	0.28	Climax	60	1	9.6	0.94
Lathrop	76	30	51.5	0.48	Coulter	59	10	16.7	0.63
Laurel	78	28	51.7	1.47	Delta	56	7	25.0	0.48
Lemoore	84	38	56.2	0.20	Denver (near)	62	10	29.5	0.00
Lewis Creek	73	24	51.6	0.39	Denver (Jesuit Col)	61	6	39.9	0.36
Livermore	81	30	52.8	0.67	Durango	60	1	1.0	1.60
Livingston	71	29	52.3	?	Fort Collins	62	16	25.3	0.34
Long Beach	85	29	55.5	0.00	Fort Crawford	54	7	28.0	0.50
Los Alamos	64	35	53.9	0.95	Fort Lewis	55	18	21.4	0.80
Los Angeles	75	29	51.0	0.45	Fort Lyon	63	8	28.5	0.50
Mammoth Tank	80	30	56.5	0.03	Georgetown	46	2	27.9	0.45
Martinez	71	32	51.0	0.85	Glenwood Springs	53	9	25.1	1.50
Marysville	80	36	53.1	0.35	Greeley	60	11	25.7	0.30
Menlo Park	69	32	51.2	0.54	Gunnison	60	1	15.8	0.02
Merced	72	26	48.8	0.15	Husted	56	9	24.0	0.25
Modesto	72	26	50.2	0.20	Julesburg	63	1	24.0	0.00
Mojave	96	26	54.9	0.00	Lamar	40	9	16.5	0.64
Montague	66	20	43.9	0.04	Leadville	65	17	35.3	0.73
Monterey	70	26	50.1	0.94	Longmont	43	25	13.4	0.00
Monterey (Hotel					Monte Vista	43	25	13.4	0.00
del Monte)	73	32	53.3	0.00	Paoli	60	1	24.8	0.68
Napa	74	32	53.3	0.06	Ouray	57	6	23.9	0.96
Needles	75	31	54.7	0.07	Rifle Falls	60	1	24.2	0.96
Newark	64	32	51.0	0.47	Rocky Ford	59	1	26.5	0.12
Newman	68	30	48.4	0.64	Saguache	60	1	13.1	0.90
Nicolaus	76	31	50.3	0.30	San Luis Exp'l Sta.	60	1	13.4	0.27
Niles	75	32	54.3	0.37	T. S. Ranch	49	4	28.6	0.84
					Thon	58	7	26.2	0.05



## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<i>Colorado—Cont'd.</i>	°	°	°	Ins.	<i>Illinois—Cont'd.</i>	°	°	°	Ins.
Walden	40	-21.6	0.48		Lake Forest	44	-13	18.0	1.27
<i>Connecticut.</i>					Lanark	44	-12	20.0	1.17
Birmingham	43	-8	1.92		Mahomet	56	-9	23.0	1.53
Clark's Falls	52	-3	24.6	2.53	Makanda	78	3	34.0	3.95
Colchester	48	2	26.1	1.39	Martinsville	50	2	27.0	1.08
Fort Trumbull	48	2	26.1	1.39	Mattoon	63	-2	30.0	0.59
Hartford	48	2	26.1	1.39	McLeansborough	73	4	32.0	2.36
Lake Konomoc	48	2	26.1	1.39	Monmouth	46	-9	27.0	2.40
Mansfield	49	-6	22.1	1.64	Mount Carmel	44	-11	18.8	1.76
Middletown	46	0	23.5	1.81	Mount Morris	44	-11	18.8	2.20
New Hartford	45	-10	17.5	2.07	Old DuQuoin	73	6	33.0	2.25
Shelton	47	1	22.8	1.46	Olney	71	3	30.0	2.66
Southampton	50	-3	23.8	1.71	Oneida	48	-10	21.0	1.30
Thompson	49	-7	21.7	1.71	Oquawka	48	-10	16.0	1.20
Uncasville	49	-7	21.7	1.71	Oswego	43	-12	18.5	1.03
Voluntown	50	-2	25.4	2.53	Ottawa	49	-11	20.0	1.16
Wallingford	49	-7	21.7	1.71	Palestine	61	1	30.5	2.20
Waterbury	43	-2	22.7	1.61	Pana	66	4	31.0	2.05
<i>Dakota.</i>					Paris	62	-3	26.0	1.17
Davenport	40	-38	2.6	0.65	Pekin	50	-10	22.0	2.00
De Smet	40	-38	2.6	0.65	Peoria	52	-5	26.0	0.84
Fort A. Lincoln	47	-23	4.3	0.50	Petersburgh	56	0	26.0	0.84
Fort Bennett	49	-27	14.4	0.43	Philo	60	0	26.0	2.19
Fort Buford	51	-34	15.4	0.30	Pontiac	52	-6	22.0	0.97
Fort Meade	52	-20	21.4	0.85	Richview	69	1	31.0	2.88
Fort Pembina	36	-43	-0.8	0.48	Riley	40	-15	15.7	1.21
Fort Randall	53	-24	19.0	0.40	Rockford	44	-14	17.4	1.51
Fort Sisseton	36	-30	4.7	0.31	Rock Island Ars'l.	50	-11	20.6	1.45
Fort Sully	53	-22	17.3	0.42	Rushville	55	-7	25.0	1.86
Fort Totten	46	-36	11.0	0.64	Sandwich	48	-1	23.6	2.88
Fort Yates	46	-26	10.4	0.60	South Evanston	45	-12	1.03	
Gallatin	40	-44	-3.0	0.53	Sterling	50	2	22.0	
Garden City	38	-29	8.5	0.53	Sumner	70	0	30.0	1.60
Goddard	44	-22	12.4	0.53	Sycamore	44	-11	18.0	0.86
Grand Forks	40	-44	4.9	1.00	Vandalia	66	1	29.0	1.40
Kimball	40	-24	10.8	1.00	Watseka	57	-7	22.0	1.70
New England City	43	-33	11.4	0.85	White Hall	57	-7	28.0	2.10
Spearfish	55	-16	22.7	1.20	Willow Hill	66	4	30.0	3.50
Spring Lake	48	-18	15.2	0.78	Winchester	59	-9	29.0	1.45
Webster	41	-33	6.9	3.94	Windsor	64	3	27.0	1.41
Woonsocket	41	-30	10.2	0.90	Winnebago	44	-16	17.0	2.00
Wolsey	41	-34	8.8	0.90	<i>Indiana.</i>				
<i>Delaware.</i>					Angola	51	-10	20.4	1.44
Kirkwood	4	27.5			Blue Lick	65	4	31.4	1.85
Newark	47	2	28.6	2.05	Butler	70	0	29.7	1.04
Viola	42	6	28.4	3.40	Cannelton	70	8	34.6	1.69
<i>District of Columbia.</i>					Columbia City	56	-1	22.1	1.40
Distribut'g Res. * f.	46	4	29.6	2.40	Columbus	62	2	28.5	1.15
Kendall Green * f.	48	4	29.6	2.40	Connorsville	64	1	26.5	0.79
Receiving Res'v' * f.	49	3	28.1		Dana	58	-4	25.5	1.37
Washington Aqu' * f.	52	8			Delphi	59	-3	23.9	1.43
<i>Florida.</i>					De Gonia Springs	67	7	33.9	1.49
Altamonte Springs	85	35	57.0	5.48	Evansville	67	7	33.1	3.25
Alva	89	40	63.4	1.87	Farmland	62	3	25.8	0.74
Fort Barancas	72	27	52.8	3.91	Franklin	65	0	25.2	1.01
Fort Meade	84	34	59.0	4.29	Huntertown	50	2	25.1	1.68
Homeland	84	37	61.9	4.20	Huntingburgh	56	4	31.7	1.80
Kissimmee City	84	35	57.0	5.48	Huntington	67	7	33.1	3.25
Manatee	84	41	61.4	4.58	Jeffersonville	67	7	33.1	3.25
Matanzas	82	35	54.0	4.24	La Fayette	59	-8	21.2	1.20
Merritt's Island	82	40	55.0	4.96	Logansport	66	9	34.9	3.62
St. Francis B'ks	81	32	53.5	4.15	Marengo	66	9	34.9	3.62
Tallahassee	81	26	51.3	3.85	Marion	56	-1	22.1	1.40
Villa City	83	38	56.7	4.37	Mauzy	62	-3	22.8	0.83
<i>Georgia.</i>					Mount Vernon (1)	66	0	25.6	1.59
Andersonville	84	19	52.1	4.13	Mount Vernon (2)	64	5	34.7	1.59
Athens	73	15	41.8	5.68	Muncie	66	0	25.6	1.59
Diamond	46	-9	19.0	1.32	New Providence	68	2	31.2	2.11
Duck	67	9	37.8	5.75	Princeton	67	2	31.3	1.90
Forsyth	76	20	48.0	6.74	Richmond	60	1	24.7	0.92
Hephzibah	74	26	46.9	5.13	Rockville	64	-4	28.0	3.00
Marietta	68	13	38.7	3.86	Rushville	64	2	30.4	1.89
Milledgeville	77	18	45.4	5.20	Salem	64	2	30.4	1.89
Quitman	78	28	51.8	5.40	Scalesville	68	6	33.3	2.49
<i>Idaho.</i>					Seymour	64	4	31.4	1.79
Boisé Barracks	64	7	31.5	T.	Spiceland	67	0	27.4	1.19
Fort Sherman	53	2	29.8	0.42	Sunman	63	1	26.9	1.00
Lewiston	60	17	35.0	0.46	Vevay	71	5	32.1	1.47
<i>Illinois.</i>					Vincennes	66	0	28.7	1.41
Atwood	60	-10	25.0	2.10	Worthington	66	0	28.7	1.41
Aledo	44	-10	22.0	1.87	<i>Indian Territory.</i>				
Aurora	46	-9	19.0	1.32	Caddo Creek	80	12	48.0	
Beason	52	-6	25.0	1.88	Cantonment	80	12	48.0	
Belvidere	43	-15	20.0	1.45	Eufaula	78	12	41.8	2.35
Benton	64	-1	26.0	1.80	Fort Gibson	78	12	41.8	2.35
Brush Hill	58	-4	26.0	2.19	Fort Reno	73	6	38.0	2.84
Camargo	64	-4	26.0	2.19	Fort Supply	80	-1	34.7	0.10
Cedarville	45	-16	17.0	1.25	Jimtown	80	-1	34.7	0.10
Centralia	74	0	30.0	1.67	Tulsa	80	-1	34.7	0.10
Charleston	64	-4	26.0	1.63	Woodward	80	-1	34.7	0.10
Collinsville	66	-1	30.6	0.47	<i>Iowa.</i>				
Dwight	50	-12	22.0	2.82	Amana	47	-14	17.2	0.47
Fairfield	73	5	34.0	1.25	Ames	48	-10	17.6	0.47
Flora	70	2	30.0	2.49	Bancroft	36	-24	11.0	T.
Fort Sheridan	45	-17	15.3	3.40	Blakeville	48	-21	12.9	0.40
Galeonda	64	8	34.0	1.15	Cedar Rapids	47	-15	18.3	0.87
Grand Tower	65	-1	28.0	2.04	Clarinda	59	0	23.0	0.12
Greenville	58	-4	30.0	2.40	Clear Lake	46	-25	15.9	0.56
Griggsville	52	-7	26.0	0.85	Cresco	40	-27	11.0	0.56
Hennepin	52	-7	26.0	0.85	Cromwell	50	-9	23.0	0.12
Irishtown	66	1	31.0	1.76	Denmark	50	-9	23.0	0.12
Jordan's Grove	70	3	31.0	2.35	Des Moines	45	-15	16.8	0.30
Kankakee	38	-10	18.0	1.02	Dunkerton	47	-19	13.8	0.20
Lacon	52	-8	23.0	0.61	Dysart	44	-19	15.4	0.82
					Elkader	40	-22	14.8	T.

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<i>Iowa—Cont'd.</i>					<i>Kentucky—Cont'd.</i>				
Fayette†	42	0	14.1	0.63	Bonnieville*	64	8	33.1	1.65
Fort Madison*	52	-7	23.8	1.50	Bowling Green†	74	9	38.4	2.34
Gillett†	52	-16	12.7	0.33	Burnside	68	8	31.0	2.55
Glenwood	62	-11	21.0	0.01	Cattlettsburgh†	68	8	31.0	2.55
Glenwood (near)*	58	-12	23.4	0.11	Eddyville†	68	8	31.0	2.55
Grinnell†	45	-14	18.1	0.30	Falmouth (1)*†	62	8	29.8	1.90
Hampton*	42	-22	20.0	0.50	Falmouth (2)†	71	7	32.7	2.25
Independence*	38	-18	16.5	0.52	Frankfort (1)	65	21	37.2	2.25
Iowa City	43	-11	19.1	1.10	Frankfort (2)†	65	21	37.2	2.25
Logan†	54	-11	22.9	1.70	Franklin*†	65	21	37.2	2.25
Manson*	52	-22	17.8	1.70	Greensburg†	65	21	37.2	2.25
Maquoketa*	46	-18	17.9	0.79	Louis†	66	11	35.0	1.66
Monticello	44	-18	17.9	0.79	Madisonville*†	68	9	36.7	1.87
Mount Pleasant*†	52	-6	26.0	1.43	Millersburg†	68	9	36.7	1.87
Mount Vernon*	48	-18	18.4	0.35	Mount Sterling*†	68	8	31.0	0.58
Muscatine*	49	-8	21.4	1.38	Newport Barracks	68	6	29.9	1.61
Osage	53	-12	21.4	0.35	Owensborough† d.	68	8	35.4	2.63
Oskaloosa*	52	-10	21.0	0.40	Owenton	65	3	30.7	2.03
Sac City*†	45	-17	15.8	0.20	Paducah†	65	3	30.7	2.03
Vinton*	42	-16	17.3	0.17	Pellville†	74	6	36.8	1.45
Washington	50	-9	23.0	0.75	Richmond†	65	5	33.0	1.36
Webster City	46	-16	15.6	0.32	Shelbyville†	72	6	33.0	2.49
Wesley†	44	-28	12.8	0.60	South Fork*†	71	8	35.9	1.90
<i>Kansas.</i>					<i>Louisiana.</i>				
Allison*	55	-4	22.4	0.26	Abbeville	76	33	55.1	1.90
Arlington	50	-8	20.0	0.65	Alexandria	76	30	52.0	1.04
Belleville	50	-7	30.8	1.25	Amite City	76	26	51.3	2.14
Bendena*	52	-7	30.8	1.25	Arcadia	81	24	54.6	2.40
Brookville	68	-2	22.0	0.25	Baton Rouge	73	31	54.6	2.40
Bucklin	68	-2	22.0	0.25	Calhoun	81	17	48.5	2.50
Buffalo Park	55	-2	22.0	0.60	Cameron	84	23	53.0	2.10
Bunker Hill	64	-5	22.0	0.45	Clinton	74	26	49.2	2.15
Burr Oak	62	-5	22.0	0.13	Convent	74	29	51.8	3.73
Cawker City	55	-10	28.2	0.50	Coushatta†	70	34	52.2	0.99
Colby	52	-11	24.4	0.11	Crowley	70	34	52.2	1.20
Cold Water	63	-5	23.0	0.30	Delhi†	74	29	49.6	3.10
Collyer	55	-2	22.0	0.30	Donaldsonville	74	29	49.6	3.10
Concordia (near)	58	-12	25.7	0.42	Farmerville	80	26	51.1	1.10
Conway	62	-5	22.0	0.50	Franklinton	79	34	56.2	3.18
Cunningham*	69	-4	28.6	0.24	Girard†	70	34	52.2	0.77
Dorrance	64	-10	22.0	0.50	Grand Cane	82	28	50.6	1.00
Elk Falls†	73	0	33.0	1.36	Grand Coteau	73	34	54.8	1.53
Ellis	58	-4	22.0	0.30	Hammond	77	27	51.6	2.61
Ellsworth	65	-4	22.0	0.30	Houma*†	75	35	53.8	4.20
Englewood*	66	-4	22.0	0.30	Jackson Barracks	79	32	53.5	2.82
Fort Hays	60	-12	27.6	0.32	Lake Charles	73	34	54.3	1.45
Ft. Leavenworth(1)	66	-6	23.6	2.30	Lake Providence	82	17	48.9	1.26
Ft. Leavenworth(2)	66	-5	28.9	2.27	Liberty Hill	84	22	49.5	1.22
Fort Riley	66	-10	26.9	0.21	Luling	75	30	51.2	3.08
Gibson	56	-14	26.9	0.69	Mandeville	73	29	51.1	3.51
Globe*	66	-5	27.0	2.04	Many	70	34	52.2	0.77
Gorham	60	-12	27.6	0.32	Marksville*†	72	32	52.6	1.37
Gove City	54	-4	27.4	0.12	Melville†	73	30	50.6	1.91
Grainfield	50	-2	22.0	0.30	Minden	86	23	51.0	1.44
Grenola	76	-4	30.5	1.00	Morgan City	80	38	54.4	0.89
Grinnell	60	-4	27.0	0.30	Monroe	80	25	49.5	0.89
Halstead	69	-6	31.0	0.30	Mount Airy	74	34	53.8	3.27
Haven	60	-12	27.6	0.32	New Iberia	74	34	54.0	1.91
Havensville†	54	-14	23.4	1.75	N. La. Exp'l St'n†	81	17	48.5	1.97
Hays City	67	0	27.6	0.50	Plaquemine	76	26	51.2	2.41
Hutchinson	67	-10	27.6	0.25	Point Pleasant	77	28	48.9	0.45
Independence*	69	-4	31.8	1.08	Port Ends	80	49	66.0	3.40
unction City	64	-9	22.0	0.80	Rayville	79	21	48.8	0.55
kanapolis	64	-9	22.0	0.31	Saint Joseph	72	37	53.0	1.13
Kirwin†	62	-10	29.4	0.62	Saint Martinville	72	37	53.0	1.13
La Harpe*	63	-11	24.5	0.25	Shell Beach	70	40	53.8	3.21
Lawrence	65	-4	27.6	1.96	Sugar Ex. station.	75	31	53.3	3.21
Lebo	70	-6	29.2	1.81	Thibodaux	75	31	53.3	3.21
Leoti†	62	-10	29.4	0.72	Vidalia	76	24	50.4	1.08
Licksville	63	-10	29.4	0.25	<i>Miss.</i>				
Manhattan*	58	-17	22.0	0.30	Bar Harbor	43	-9	21.0	3.88
McAlister	58	-17	22.0	0.30	Belfast	40	-9	20.4	3.88
McPherson	58	-17	22.0	0.30	Calais	44	-18	15.3	3.88
Monterey	57	-9	27.0	0.40	Cornish	43	-14	17.2	3.00
Monument	58	-10	27.0	0.55	Fairfield	42	-37	14.8	2.12
Morse*	60	-10	35.0	3.00	Gardiner	45	-16	18.9	1.84
Mukley	60	-10	35.0	3.00	Kent's Hill	38	-17	16.5	3.45
Murbin†	58	-8	22.0	0.23	Lewiston	41	-23	15.3	3.21
Muscatine	58	-8	22.0	0.50	Orono†	45	-20	16.0	5.20
Nashville	58	-8	22.0	0.50	Petit Menard	40	-5	31.8	3.88
Nashville	58	-8	22.0	0.50	<i>Maryland.</i>				
Nashville	58	-8	22.0	0.50	Barren Creek Sp'gs†	54	11	31.6	3.74
Nashville	58	-8	22.0	0.50	Cumberland	54	0	28.0	2.07
Nashville	58	-8	22.0	0.50	Fallston	45	1	27.7	2.22
Nashville	58	-8	22.0	0.50	Fort McHenry	47	3	31.6	2.60
Nashville	58	-8	22.0	0.50	Frederick	50	4	28.9	2.18
Nashville	58	-8	22.0	0.50	Gaithersburg*	50	5	25.6	2.18
Nashville	58	-8	22.0	0.50	Galena*†	40	6	29.6	2.48
Nashville	58	-8	22.0	0.50	Great Falls*	47	4	29.6	2.48
Nashville	58	-8	22.0	0.50	Jewell†	40	6	30.0	2.95
Nashville	58	-8	22.0	0.50	McDonogh	43	1	28.0	2.37
Nashville	58	-8	22.0	0.50	Mt. St. Mary's Colf.	44	-1	27.7	1.24
Nashville	58	-8	22.0	0.50	<i>Massachusetts.</i>				
Nashville	58	-8	22.0	0.50	Amherst	45	-5	23.2	1.46
Nashville	58	-8	22.0	0.50	Amherst Ex Sta.	42	-9	20.8	1.45
Nashville	58	-8	22.0	0.50	Blue Hill (sum't)†	45	0	22.2	1.81
Nashville	58	-8	22.0	0.50	Blue Hill (base)	47	-4	23.9	2.02
Nashville	58	-8	22.0	0.50	Blue Hill (valley)	47	-4	23.9	1.92
Nashville	58	-8	22.0	0.50	Boston	50	1	27.0	1.54
Nashville	58	-8	22.0	0.50	Brewster	48	5	27.6	4.07
Nashville	58	-8	22.0	0.50	Cambridge (1)	45	-4	23.0	1.47
Nashville	58	-8	22.0	0.50	Cambridge (2)	47	-1	23.7	2.81
Nashville	58	-8	22.0	0.50	Chestnut Hill	47	-4	25.0	1.93
Nashville	58	-8	22.0	0.50	Clinton	43	-2	25.6	3.71
Nashville	58	-8	22.0	0.50	Cotuit	43	-2	25.6	3.71

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
<b>Massachusetts—Con.</b>	0	0	0	Ins.	<b>Michigan—Cont'd.</b>	0	0	0	Ins.
Deerfield (1).....	45	-14	20.0	1.72	Gladwin.....	46	-32	11.6	2.00
Deerfield (2).....	46	-13	21.0	1.72	Grand Rapids.....	47	-13	18.6	0.66
Dudley.....	46	-9	21.4	1.31	Grape.....	36	-20	11.2	0.66
Fall River.....	45	-3	25.0	2.68	Gulliver Lake.....	36	-20	11.2	0.66
Fitchburg.....	45	-9	20.8	1.98	Hannover.....	39	-8	19.8	1.12
Fitchburg (1).....	45	-9	20.8	1.72	Hartsville.....	39	-8	14.0	2.62
Fitchburg (2).....	49	-10	20.9	1.84	Hastings.....	47	-20	16.4	2.58
Fort Warren.....	52	-1	26.3	1.30	Hayes.....	45	-12	19.6	1.49
Frammingham.....	45	-5	24.2	1.65	Hillman.....	48	-17	10.3	0.71
Gilbertville.....	39	-7	20.2	1.13	Hillsdale.....	44	-10	18.3	0.57
Groton.....	50	-10	22.6	1.45	Highland Station.....	46	-15	15.2	0.87
Heath.....	54	-20	18.6	1.56	Hudson.....	48	-10	19.7	1.73
Holyoke.....	49	-4	25.0	1.53	Ionia.....	40	-16	14.4	1.11
Lake Cochituate.....	50	-8	24.4	1.56	Jeddo.....	42	-14	18.9	0.86
Lawrence.....	47	-7	23.3	1.65	Kalamazoo.....	46	-11	21.2	1.35
Leicester.....	40	-9	18.9	1.43	Kenosha.....	42	-15	18.9	1.02
Leominster.....	43	-6	22.7	2.69	Lansing.....	44	-33	9.2	1.88
Long Plain.....	49	-7	23.7	1.71	Lathrop.....	40	-8	16.2	1.07
Lowell (1).....	46	-6	23.4	1.71	Madison.....	44	-8	21.8	1.84
Lowell (2).....	44	-8	20.5	1.97	Marshall.....	43	-8	15.1	0.57
Lynn.....	44	-1	23.7	2.36	May.....	41	-17	15.1	2.80
Mansfield.....	45	-7	23.9	2.48	Mio.....	41	-17	10.2	0.57
Medford.....	47	-1	24.8	1.71	Mottville.....	36	-13	17.0	2.88
Middleborough.....	47	-4	24.8	2.56	Noble.....	49	-10	18.1	0.68
Milton.....	48	-1	26.0	2.04	North Aurelius.....	44	-10	18.1	1.19
Mystic Lake.....	47	-1	24.8	1.95	North Marshall.....	44	-10	16.7	1.06
Mystic Station.....	47	-1	24.8	1.80	Northport.....	39	-10	16.7	2.92
Nantucket (1).....	46	-3	28.4	4.07	Olivet.....	45	-14	18.0	1.25
Nantucket (2).....	48	-4	29.6	4.23	Omer.....	45	-13	12.3	2.40
New Bedford (1).....	44	-4	25.2	3.00	Ovid.....	41	-18	15.4	1.08
New Bedford (2).....	42	-5	25.2	2.92	Paw Paw.....	43	-19	18.5	2.04
New Bedford (3).....	46	-3	25.7	2.75	Petersburgh.....	50	-8	17.9	1.80
Newburyport (1).....	46	-4	24.4	2.30	Pontiac.....	44	-10	19.9	0.62
Newburyport (2).....	41	-9	21.6	1.81	Pulaski.....	48	-4	18.9	0.97
North Billerica.....	53	-6	24.0	1.56	Roscommon.....	40	-9	18.2	2.00
Plymouth.....	52	-6	27.9	2.61	Saint John's.....	44	-12	16.1	1.53
Princeton.....	40	-13	19.3	1.13	Saint Louis.....	42	-16	18.0	0.99
Provincetown.....	44	-3	27.4	4.04	Sand Beach.....	37	-17	16.5	0.69
Randolph.....	41	-22	17.0	1.80	Stanton.....	49	-20	14.3	1.15
Rose.....	45	-6	24.3	1.79	Stockbridge.....	43	-31	17.4	1.51
Royalton.....	48	-1	25.0	2.07	Swartz Creek.....	40	-22	16.5	4.38
Salem (1).....	42	-1	25.0	2.12	Thornville.....	44	-23	18.3	1.17
Salem (2).....	50	-6	25.3	2.28	Washington.....	46	-19	14.3	1.33
South Hingham.....	42	-6	23.0	1.71	Vandalia.....	42	-10	16.1	1.51
Springfield Arm'y.....	43	-2	23.4	1.69	Vienna.....	44	-12	19.9	1.43
Springfield.....	47	-2	25.6	2.22	Williamston.....	44	-12	19.9	1.47
Taunton (1).....	45	-4	25.0	2.19	Weldon Creek.....	47	-4	24.8	4.07
Taunton (2).....	47	-4	24.8	2.21	Ypsilanti (1).....	42	-8	21.5	1.05
Taunton (3).....	47	-4	24.8	1.53	Ypsilanti (2).....	41	-11	19.0	1.12
Waltham.....	45	-6	24.8	1.79	<b>Minnesota.</b>				
Wellesley.....	45	-6	24.8	1.63	Alexandria.....	47	-30	9.3	0.96
Westborough.....	58	-5	24.2	1.63	Delano.....	47	-30	9.3	0.91
Williamstown.....	41	-14	19.3	1.22	Farmington.....	46	-26	10.0	0.95
Winchester.....	44	-7	20.6	1.83	Fergus Falls.....	46	-26	10.0	0.40
Worcester (1).....	44	-7	20.6	1.83	Fort Ripley.....	37	-39	5.9	0.58
Worcester (2).....	45	-4	22.8	0.16	Grand Meadow.....	47	-30	11.2	0.26
<b>Mexico.</b>					L. Winnibigoshish.....	52	-40	3.1	1.86
Guanajuata.....	78	41	59.9	0.10	Le Sueur.....	50	-26	11.3	1.09
La Logia.....	80	42	63.2	0.10	Mankato.....	50	-23	13.4	0.51
Leon de Aldemas.....	76	64	69.8	0.04	Medford.....	46	-34	8.8	0.50
Masatlan.....	79	39	59.5	0.04	Minneapolis.....	47	-36	10.4	1.36
Mexico.....	84	54	64.0	0.49	Morris.....	39	-36	4.9	0.32
Topo Chico.....	72	33	53.0	0.49	Morton.....	48	-27	11.6	1.13
Zacatecas.....	72	33	53.0	0.49	Ortonville.....	46	-44	1.4	0.66
<b>Michigan.</b>					Pine River.....	46	-44	1.4	0.66
Adrian.....	40	-12	16.5	1.18	Pokegama Falls.....	50	-25	11.1	0.54
Albion.....	44	-5	22.1	1.77	Red Wing.....	48	-25	11.1	0.54
Allegan.....	48	-24	13.5	1.68	Redwood Falls.....	42	-24	9.7	0.85
Arbela.....	50	-24	8.5	1.43	Rolling Green.....	42	-24	9.7	0.85
Atlantic.....	42	-10	14.7	3.25	Saint Cloud.....	49	-30	8.0	0.07
Beaumont.....	40	-10	18.0	3.16	Tracy.....	43	-26	10.2	0.07
Benton Harbor.....	41	-8	19.8	3.16	<b>Mississippi.</b>				
Benzonia.....	36	-12	15.5	3.97	Batesville.....	76	15	43.3	3.60
Berlin.....	43	-23	16.2	1.21	Canton.....	78	23	49.0	0.53
Berrien Springs.....	43	-16	21.4	2.75	Edwards.....	78	23	49.0	0.53
Big Rapids.....	45	-27	13.7	2.59	Greenville.....	81	25	46.5	2.71
Birmingham.....	45	-18	17.5	1.90	Holly Springs.....	72	20	42.0	1.50
Bronson.....	46	-8	16.7	1.21	Kosciusko.....	76	20	44.4	1.50
Buchanan.....	44	-9	20.6	1.65	Lamar.....	74	30	51.7	0.68
Calumet.....	46	-23	8.5	1.94	Loch Leven.....	75	31	53.0	0.47
Cassopolis.....	45	-8	20.5	2.62	Logtown.....	73	30	51.2	1.99
Charlevoix.....	37	-10	13.5	1.05	Louisville.....	81	20	51.2	1.99
Chase.....	46	-32	12.1	1.05	Palo Alto.....	78	19	44.5	2.58
Chelsea.....	49	-9	18.6	1.45	Pearlington.....	75	31	53.6	3.47
Clinton.....	42	-6	13.7	1.57	Pontotoc.....	65	19	41.2	3.00
Colon.....	48	-6	20.9	1.08	Rienzi.....	68	18	43.5	4.14
Columbia.....	48	-6	20.9	1.08	Starkville.....	80	15	45.9	2.47
Concord.....	50	-7	18.1	0.93	Summit.....	72	24	47.4	3.12
Corunna.....	53	-14	15.4	1.25	Water Valley.....	81	18	42.8	3.73
Deer Lake.....	38	-26	16.5	2.65	Waynesborough.....	71	25	44.6	1.89
East Saginaw.....	43	-18	16.4	2.33	Yazoo City.....	71	25	44.6	1.89
East Tawas.....	39	-17	15.4	1.80	<b>Missouri.</b>				
Eden.....	46	-15	18.8	1.28	Carthage.....	58	-6	24.5	4.54
Fitchburg.....	43	-22	13.0	1.13	Craig.....	58	-6	24.5	4.54
Fletcher.....	44	-22	15.6	1.62	Excelsior Springs.....	65	-7	24.5	2.36
Flint.....	44	-23	7.5	1.21	Fayette.....	69	-5	29.4	3.05
Fort Brady.....	34	-15	10.1	1.39	Fox Creek.....	72	-3	30.5	2.66
Fort Mackinac.....	45	-7	19.1	2.26	Frankford (1).....	60	-4	27.8	3.15
Fort Wayne.....	34	-12	15.6	2.23					

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.		Temperature. (Fahrenheit.)			Precip'n.	Stations.		Temperature. (Fahrenheit.)			Precip'n.
Max.	Min.	Mean		Max.		Min.	Mean				
Missouri—Cont'd.						Nevada—Cont'd.					
Frankford (2).....	73	-5	27.9	2.58	Mill City*.....	54	6	38.0	0.00		
Glasgow.....	73	-5	27.9	2.06	Montello *.....	54	6	25.1	0.00		
Grand Pass.....	68	-1	27.3	1.58	Palisade *.....	54	0	26.9	0.00		
Harrisonville.....	66	-7	27.1	2.18	Pioche *.....	60	-3	30.4	0.79		
Hermann ?.....	70	-4	33.6	3.71	Reno State Univ'ty.....	54	0	35.4	0.29		
Ironson.....	59	4	33.6	3.65	Reno *.....	62	8	34.3	0.00		
Jefferson Barracks.....	59	-10	33.2	4.00	Tecoma *.....	56	0	27.2	0.00		
Kidder.....	60	-7	24.6	1.20	Toano *.....	50	3	25.2	0.00		
Kirkville.....	60	-7	24.6	1.42	Tuscarora *.....	51	0	26.4	0.24		
Lakeland *.....	60	0	20.4	1.75	Verdi *.....	51	0	33.9	0.40		
Lamotte.....	65	-3	29.6	3.00	Wellington.....	53	4	32.9	0.00		
Langdon.....	70	-6	27.4	0.54	Wells *.....	57	10	20.7	0.00		
Mexico.....	70	-6	27.4	1.99	Winnemucca *.....	69	3	29.8	0.00		
Miami.....	72	-6	27.4	1.97	New Hampshire.						
Mount City.....	59	-9	27.5	1.51	Antrim.....	54	0	1.91	1.91		
New Haven.....	59	3	37.9	2.50	Belmont.....	48	-28	10.4	1.63		
Oak Ridge.....	62	9	25.4	1.45	Berlin Mills.....	48	-28	10.4	1.63		
Oregon.....	64	-8	25.4	1.45	Bristol.....	50	-14	31.2	1.53		
Ozark *.....	69	0	32.5	3.00	Concord.....	42	-25	15.2	2.17		
Pierce City *.....	69	-2	32.4	4.20	Hanover.....	47	-27	17.2	0.77		
Princeton ?.....	61	-6	26.7	0.80	Lake Village.....	50	-16	15.0	1.86		
Saint Charles (1).....	70	-1	30.2	2.78	Manchester (1).....	51	-9	21.5	1.86		
Saint Charles (2).....	70	-2	30.2	3.10	Manchester (2).....	48	-12	20.3	1.90		
Savannah.....	63	-7	32.8	0.80	Manchester (3).....	50	-9	21.2	1.71		
Sedalia.....	73	-4	29.1	2.21	Mine Falls.....	47	-27	17.2	0.77		
Shelby.....	73	-4	29.1	1.63	Nashua.....	47	-8	21.8	1.72		
Steelville.....	70	-3	29.1	4.60	North Chesterfield.....	45	-30	12.6	1.78		
Troy.....	73	-4	29.1	2.50	North Conway.....	44	-21	16.7	2.71		
Warrenton.....	70	-2	25.4	2.30	North Sutton.....	47	-21	16.0	2.20		
Wither's Mill.....	66	-4	25.4	2.30	Pennichuck Sta.....	44	-24	13.9	2.86		
Willow Springs.....	66	-4	25.4	1.32	Shaker Village.....	44	-10	19.0	2.00		
Montana.					New Jersey.						
Camp Poplar River.....	58	-35	17.3	0.15	Allaire.....	52	1	27.2	0.00		
Custer ?.....	60	-29	22.8	0.25	Asbury Park.....	49	1	28.5	2.58		
Fort Assinaboine.....	54	-24	21.5	0.45	Beverly ?.....	50	2	27.4	2.17		
Fort Custer.....	55	-25	17.7	0.68	Billingsport L. H.....	46	4	29.2	0.00		
Fort Keogh.....	57	-23	24.2	1.46	Bridgeport.....	51	6	32.9	2.70		
Fort Maginnis.....	53	-20	24.4	0.70	Cape May C. H.....	50	5	31.4	0.00		
Fort Missoula.....	58	-20	24.4	0.37	Clayton.....	52	4	29.9	2.28		
Fort Shaw.....	60	-10	24.0	1.03	Egg Harbor City.....	50	1	28.3	2.51		
Galpin ?.....	49	-11	24.6	0.11	Freehold.....	50	-2	27.0	2.00		
Sheldon *.....	51	-11	24.6	0.11	Gillette.....	50	-2	26.3	1.93		
Nebraska.					New Mexico.						
Anselby ?.....	60	-9	22.8	0.14	Hanover.....	50	4	28.4	2.16		
Ashland.....	48	-20	16.9	0.31	Highland Park.....	50	0	26.8	2.41		
Creighton ?.....	55	-27	16.9	0.51	Hopewell.....	48	0	27.2	1.65		
Crete.....	52	-16	22.3	0.13	Imlaystown.....	48	0	27.2	2.18		
Culbertson (1) *.....	60	-14	25.7	0.20	Jersey City.....	48	4	29.0	0.00		
Culbertson (2) ?.....	60	-14	25.7	0.23	Lambertville.....	45	3	28.0	1.98		
David City.....	51	-11	22.0	0.30	Locktown.....	44	-3	25.2	2.04		
De Soto.....	51	-11	22.0	0.30	Madison.....	46	1	25.1	2.37		
Fairbury.....	56	-6	26.1	0.18	Moorestown ?.....	43	0	27.0	2.27		
Falls City.....	59	-13	22.4	0.06	New Brunswick (1).....	47	5	28.2	2.38		
Fort Niobrara.....	59	-16	19.6	0.32	New Brunswick (2).....	51	0	26.8	2.35		
Fort Omaha.....	58	-9	26.1	0.14	New Brunswick (3).....	52	0	27.3	0.00		
Fort Robinson.....	64	-17	27.1	0.78	Newark.....	48	5	27.2	2.68		
Fort Sidney.....	60	-10	23.7	0.30	Ocean City.....	45	2	31.1	3.80		
Franklin.....	54	-8	19.4	0.20	Oceanic.....	52	4	29.4	2.95		
Freemont.....	49	-20	21.9	0.35	Paterson.....	51	1	27.1	2.84		
Genoa.....	51	-19	21.3	0.10	Plainfield.....	57	-1	27.0	2.84		
Hay Springs.....	56	-20	18.6	0.94	Princeton.....	46	0	26.6	2.33		
Kennedy.....	63	-13	20.7	0.62	Rancocas.....	46	0	25.5	2.25		
Kimball ?.....	59	-11	27.4	0.12	Readington *.....	48	2	30.2	0.00		
Lincoln.....	53	-17	23.4	0.23	Somerville.....	49	3	27.3	3.31		
Marquette *.....	53	-10	25.1	0.15	South Orange.....	48	0	25.2	2.49		
Minden.....	54	-16	23.6	0.29	Tenafly.....	55	0	24.4	2.18		
Nebraska City.....	56	-12	23.6	0.13	Tom's River.....	52	0	27.7	2.95		
North Loup ?.....	50	-10	22.1	0.11	Trenton.....	49	-2	29.0	3.30		
Oakdale.....	56	-26	16.9	0.13	Union.....	46	0	25.7	2.30		
Palmer.....	52	-10	20.3	0.10	Vineland.....	51	3	30.7	2.17		
Ravenna.....	54	-8	20.3	0.03	New Mexico.						
Red Willow.....	51	-14	21.6	0.17	Coolidge.....	52	-19	22.5	0.80		
Sargent.....	57	-8	24.1	0.40	Deming *.....	70	12	41.8	0.00		
Syracuse *.....	48	-15	23.1	0.90	Embudo *.....	55	0	29.3	0.37		
Tecumseh ?.....	52	-13	21.7	0.24	Fort Bayard.....	67	10	30.0	0.41		
Weeping Water *.....	53	-12	21.7	0.37	Fort Seldon ?.....	72	24	48.2	0.51		
West Hill.....	50	-21	19.3	0.07	Fort Union.....	58	7	30.9	0.70		
West Point.....	52	-20	20.0	0.10	Fort Wingate.....	46	7	28.4	1.60		
Nevada.					New York.						
Austin.....	51	-6	31.8	0.00	Gallinas Spring ?.....	59	13	40.3	0.22		
Battle Mountain *.....	58	-2	26.7	0.00	Las Vegas ?.....	58	0	27.2	0.22		
Beowawe (1).....	60	-8	25.0	0.00	Lordsburg *.....	69	14	42.4	0.45		
Beowawe (2) *.....	60	-8	25.0	0.00	Springer ?.....	50	0	26.8	0.00		
Brown's *.....	66	4	35.7	0.00	New York.						
Burner's Ranch.....	62	-7	21.5	0.20	Angelica ?.....	38	-23	17.0	1.26		
Carlin *.....	57	-4	34.9	0.27	Ardena *.....	48	5	26.0	2.40		
Carson City.....	62	-4	34.9	0.20	Barnes' Corners * ?.....	41	-34	13.7	1.57		
Crane's Ranch.....	64	10	35.6	0.17	Boyd's Corners *.....	47	-3	24.2	2.33		
Dayton.....	75	32	55.0	T.	Canton ?.....	40	-35	11.3	2.52		
El Dorado.....	72	-11	31.2	T.	Constableville ?.....	40	-25	12.9	5.46		
Elko (1).....	55	-5	24.7	0.00	Cooperstown *.....	41	-15	16.1	1.79		
Elko (2) *.....	65	-7	29.4	0.64	David's Island.....	50	-1	36.2	2.35		
Ely.....	54	-4	27.6	0.03	Eden *.....	44	2	31.2	5.17		
Eureka.....	62	-4	35.8	0.00	Elmira ?.....	41	-7	21.4	0.75		
Fort McDermitt.....	58	8	37.2	0.00	Factoryville ?.....	43	-13	18.7	1.79		
Genoa.....	75	10	35.1	0.00	Fleming *.....	47	-4	15.8	0.00		
Golconda.....	56	-8	24.3	0.27	Fort Columbus.....	49	1	18.2	3.09		
Halleck.....	70	8	39.3	0.27	Fort Hamilton.....	47	2	27.9	0.26		
Hawthorne *.....	69	10	34.2	0.00	Fort Niagara.....	46	-6	31.8	0.69		
Hot Springs (1).....	69	10	34.2	0.00	Fort Porter.....	44	-11	17.7	2.19		
Hot Springs (2) *.....	69	10	34.2	0.00	Fort Wadsworth.....	50	1	27.7	2.63		
Humboldt (1).....	68	10	34.2	0.00							
Humboldt (2) *.....	68	10	34.2	0.00							
Lewer's Ranch *.....	63	1	35.9	0.46							



## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
New York—Cont'd.	°	°	°	Ins.	Ohio—Cont'd.	°	°	°	Ins.
Friendship*	40	-18	19.9	2.45	Portsmouth (1)†	68	8	33.5	1.99
Geneva	43	-12	20.3	1.21	Portsmouth (2)	68	8	33.5	1.95
Hess Road Sta*†	40	-9	19.3	4.62	Quaker City	57	-3	27.7	1.77
Hudson	40	0	18.0		Ruggles†	52	-5	23.4	2.20
Humphrey*	38	-16	16.8	1.03	Sidney	59	0	25.5	1.27
Ilion*†	41	-20	17.5	2.80	Springborough	53			1.00
Ithaca	44	-12	20.0	1.30	Tiffin*	53	1	24.2	1.22
Kingston	46	4	21.0	1.98	Upper Sandusky	53	-4	24.9	1.58
Le Roy	44	9	17.8	1.73	Wapakoneta	46	-4	24.5	0.77
Lowville*	45	-24	16.6	7.14	Wauseon	52	-13	30.2	1.77
Lyons	41	3	19.4	2.59	Waynesville	57	0	25.8	1.00
Madison Barracks	44	-26	13.1	1.18	Westerville	62	2	29.5	2.40
Middleburgh†	52	-22	20.9	2.05	West Milton	54	-5	22.9	1.71
Newane Station*	44	-14	19.0		Weymouth	54	-5	22.9	1.71
Nineveh	44	-30	11.2	3.18	Wooster (1)†	66	-2	27.7	0.70
North Hammond†	48	-22	12.6	1.01	Wooster (2)	66	-2	27.7	0.70
Number Four†	40	-27	11.6	5.42	Yellow Springs	45	-8	24.8	0.42
Palermo	40	-9	18.4	2.83	Youngstown	45	-8	24.8	0.42
Palmyra	42	-9	19.4		Zanesville†	59	0	25.5	1.27
Pendleton Centre*	44	-4	17.1						
Penn Yan	42	-5	19.4	1.26	Oregon	68	26	44.8	0.98
Perry City*	42	-14	16.8	2.03	Albany†	67	26	49.2	2.57
Plattsburgh B'ks†	48	-20	17.8	0.32	Bandon*	64	20	42.6	0.16
Potsdam*	48	-26	12.0	4.66	East Portland	61	21	42.6	0.35
Queensbury*†	45	-24	18.7		Eola*	61	21	42.6	0.35
Salem	45	-34	13.6	3.59	Fort Klamath	63	3	31.8	0.04
Saranac Lake†	43	-13	18.2	1.37	McMinnville†	60	20	42.1	0.93
Savona†	54	5	27.4	2.19	Mount Angel†	65	25	43.8	0.80
Setauket	48	-14	17.6		Parkers†	72	17	43.4	
Somerset	48	-12	21.1		Siskiyou*	72	29	49.9	3.54
South Canisteo*	45	-14	17.0	0.86	Tillamook*†	72	29	49.9	3.54
South Kortright*†	45	-14	17.0	0.86	Pennsylvania	54	-3	27.6	1.50
Utica	42	-23	16.5	4.94	Allegheny Arsenal	51	-3	29.8	1.24
Watervleit Arsenal	44	-8	19.8	2.20	Altoona	51	-3	29.8	1.24
Wedgewood*	44	-12	17.9	2.28	Aqueduct	42	-1	27.0	1.94
West Point	50	-4	23.0	2.88	Bethlehem	50	-12	3.66	
White Plains*	46	4	27.3	3.19	Blooming Grove	42	-1	27.0	1.94
Willett's Point	46	1	26.6	2.33	Brookville†	42	0	26.1	1.68
North Carolina					Carlisle	42	0	26.1	1.68
Asheville (1)	70	6	36.3	1.68	Catswissa	48	-5	26.7	1.61
Asheville (2)†	70	6	36.3	1.68	Charlesville	51	-9	24.0	1.53
Chapel Hill	68	10	37.9	4.24	Clarion (1)†	46	-21	30.0	2.10
Charleston†	69	11	38.4		Clarion (2)	49	-3	25.6	1.85
Hot Springs	62	8	35.9	2.40	Coatesville	42	-26	18.4	1.53
Lenoir*	69	11	38.4		Columbus	42	-26	18.4	1.53
Morganton†	65	21	38.8	2.58	Confluence†	49	-3	25.6	1.85
Mount Holly†	66	10	37.0	3.77	Corry	42	-26	18.4	1.53
Mount Pleasant	66	10	37.0	3.77	Coudersport	44	-27	17.8	1.90
Monroe	67	16	39.8	3.71	Drifton†	47	-13	18.7	1.46
Murphy†	68	13	38.8	2.65	Dyberry	41	-20	17.4	
New Berne	68	13	38.8	2.65	Eagle's Mere	40	-17	12.0	3.87
Raleigh	67	17	40.0	2.64	East Brook*	39	-9	20.8	
Salisbury	67	17	40.0	2.64	Easton*	39	-9	20.8	
Statesville	67	12	36.9	6.66	Edinborough	40	-21	17.4	0.60
Southern Pines	72	20	44.4	3.65	Emporium	45	-20	21.8	1.61
Wake Forest†	66	11	38.8	2.25	Franklin*	38	-22	19.6	1.68
Washington	71	28	40.8	4.35	Frankford Arsenal	50	-2	26.0	1.87
Weldon†	66	11	37.1	3.53	Freeport†	44	-1	25.8	2.01
Ohio					Germantown	44	1	25.8	2.01
Akron	54	-5	22.9	1.05	Girardville	41	-4	23.1	1.66
Ashland	63	3	29.8	1.78	Grampian Hills	42	-24	18.4	1.96
Athens	56	-6	22.8	1.43	Greensborough†	49	-17	19.1	1.18
Bangorville	50	-3	22.6	1.40	Greenville	49	-17	19.1	1.18
Bellevue*	50	-3	22.6	1.40	Hollidaysburgh	49	-7	24.0	1.91
Caledonia†	54	-4	24.1	1.13	Honesdale	39	-15	16.0	3.10
Canton (1)†	54	-4	24.1	1.13	Huntingdon	41	-8	24.0	0.97
Canton (2)†	61	-1	26.1	1.38	Indiana	60	-11	26.4	2.42
Celina	61	-1	26.1	1.38	Johnstown†	44	1	26.4	2.16
Circleville†	65	3	26.9	1.23	Lancaster	44	1	26.4	2.16
Clarksville	47	-7	24.3	1.20	Lebanon	45	0	25.8	1.85
Cleveland	47	-7	24.3	1.20	Le Roy*	48	-18	16.9	1.38
College Hill*	66	5	29.6	1.90	Lock Haven	49	-11	22.0	1.74
Collinwood*	49	-2	23.0	0.95	Lock No. 4†	49	-11	22.0	1.74
Columbus Barracks	62	0	27.3	1.24	Mahoning†	56	2	26.4	1.65
Dayton	64	1	28.4	0.51	McConnellsburch	45	-9	23.2	3.85
Demon	52	0	25.4	1.82	Meadville†	45	-9	23.2	3.85
Elyria	53	-4	23.3	2.15	Meshoppen	45	-9	23.2	3.85
Fostoria	55	-4	23.3	0.76	Mount Joy	51	0	22.3	1.24
Gallipolis†	45	-18	20.6	1.42	New Bloomfield	50	-11	24.7	3.33
Garrettsville	65	6	29.9	2.22	New Castle	50	-11	24.7	3.33
Georgetown	60	-5	27.3	3.58	Nisbet	49	-2	21.3	1.80
Gracey	60	-1	24.8	1.25	Oil City†	49	-11	22.0	1.74
Granville	59	0	25.1	0.92	Parkers Landing†	49	-11	22.0	1.74
Greenville	59	0	25.1	0.92	Petersburgh	56	-19	19.2	1.87
Hanging Rock	67	6	31.6	1.48	Philipsburgh†	44	0	23.5	1.92
Hiram	50	-12	20.8	1.31	Pleasant Mount *g.	46	-4	24.3	2.38
Hudson	62	0	26.8	0.60	Pottstown	44	0	23.5	1.92
Jacksonborough	44	-14	20.3	1.82	Quakertown	46	-4	24.3	2.38
Jefferson	50	-6	24.6	1.67	Reading†	44	-4	24.6	1.66
Kent	49	-2	23.5	1.28	Rimersburgh	42	-13	20.2	
Kenton†	49	-2	23.5	1.28	Salem Corners*	40	-7	17.7	2.64
Logan	44	-12	22.5	1.06	Saltsburgh†	46	-4	24.8	1.52
Lordstown	44	-12	22.5	1.06	Selin's Grove	43	-27	20.8	3.73
Mansfield†	58	3	30.3	2.44	Smethport	50	-13	21.0	1.92
Marietta (1)†	57	0	28.6	2.00	Somerset	48	-14	21.8	1.34
Marietta (2)	57	0	28.6	2.00	State College	48	0	28.1	1.92
McConnellsville	55	-3	25.8	1.21	Swarthmore	46	-16	20.1	1.92
Napoleon†	55	-3	25.8	1.21	Troy*	46	-16	20.1	1.92
New Alexandria	56	-1	26.0	1.65	Tuscarora	46	-16	20.1	1.92
New Comerstown	56	-1	26.0	1.65	Uniontown	58	-1	30.0	2.43
North Lewisburgh	52	-4	22.4	0.53	Warren†	54	-20	18.8	2.98
Oberlin	62	1	26.4	0.84	Wellsbrough	46	-2	26.6	2.46
O. S. University	60	8	33.4	1.90	West Chester	47	2	28.4	1.74
Ottawa					Westtown	44	-15	17.1	1.73
Pomeroy					Wysox				

## Meteorological record of voluntary observers, &amp;c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean.			Max.	Min.	Mean.	
<i>Rhode Island.</i>					<i>Texas—Cont'd.</i>				
Bristol	46	0	26.2	2.35	Mexia†	85	18	52.4	1.00
Fort Adams	47	-1	25.0	1.74	New Braunfels†	74	30	52.2	3.73
Kingston	47	-1	25.0	2.92	New Ulm	81	27	55.0	2.73
Lonsdale	46	1	27.8	2.02	San Antonio	81	33	55.0	3.70
Newport	46	1	27.8	2.02	Silver Falls†	78	8	41.0	0.60
Olneyville	50	-2	28.2	2.40	Snyder	55	11	33.0	2.20
Pawtucket	48	0	26.4	2.55	Victoria*	79	34	57.7	3.65
Providence (1)	48	0	26.4	2.55	Waco†	77	21	52.1	3.00
Providence (2)	46	-4	25.2	2.06					
Woonsocket	46	-4	24.0	1.45					
<i>South Carolina.</i>					<i>Utah.</i>				
Aiken	75	19	45.0	5.33	Blue Creek*	49	9	27.6	0.00
Belmont	67	15	41.8	6.80	Corinne*	54	2	28.3	
Brewer Mine	66	12	40.9	3.40	Fort Douglas	53	9	29.0	
Cedar Springs†	68	16	38.4	5.60	Fort DuChesne	45	-17	14.5	0.18
Clinton	68	23	40.7	3.67	Kelton*	50	0	27.7	0.00
Columbia (Ex.Sta.)	69	17	41.9	6.58	Ogden*	54	10	30.6	
Evergreen	61	10	35.5	6.56	Pricet†				0.40
Kirkwood*	69	19	43.3	5.47	Promontory*	60	4	26.0	
Statesburgh†	64	24	44.0	7.33	Terrace*	50	0	26.0	0.00
Timmonsville	70	20	43.5	5.33					
Trial	68	10	41.9	5.93					
Winnsborough	67	11	42.0	5.19					
Yorkville	67	11	42.0	5.19					
<i>Tennessee.</i>					<i>Vermont.</i>				
Andersonville	60	9	39.0	4.90	Brattleborough (1)	43	-18	19.4	1.72
Ashwood*†	71	14	39.8	2.71	Brattleborough (2)	44	-14	18.1	
Austin†	73	9	39.1	3.71	Burlington	45	-15	19.0	1.59
Carthage				2.71	Cornwall				1.20
Charlotte				4.71	Chelsea	42	-21	14.5	2.35
Clarksville	69	11	37.5	1.31	East Berkshire†	56	-35	14.4	1.40
Clinton				5.60	Jacksonville	52	30	15.8	2.37
Cog Hill	73	5	34.6	3.50	Lunenburg	50	-25	14.8	1.84
Columbia†				1.70	Middlebury	39	-24	15.8	1.10
Covington	70	18	42.0	1.65	Saint Johnsbury*	42	-31	12.0	0.65
Fayetteville	72	12	41.6	3.70	Saxton's River	47	-25	15.2	0.99
Florence Station	67	15	39.6	3.46	Strafford*	40	-20	14.2	3.25
Greenville	63	9	35.9	2.43	Vernon	44	-20	20.9	1.90
Hohenwald	73	6	38.0	2.67					
Jacksborough	60	8	37.3	2.99					
Johnsonville†				2.05					
Kingston†				6.23					
Kingston Springs	63	7	37.4	2.20					
Lawrenceburgh	68	6	38.0	4.09					
Leeville	65	8	39.0	1.93					
Lookout Mountain	65	10	37.7	3.28					
Loudon				5.51					
McKenzie	74	16	40.0	1.50					
Milan	73	14	36.1	1.31					
Nunnely	70	7	38.6	2.74					
Parksville	70	11	40.3	4.27					
Riddleton	70	8	37.5	3.81					
Rockwood†				3.20					
Rogersville	60	8	36.7	3.58					
Savannah	72	22	43.4	3.90					
Springdale	64	6	38.2	2.90					
Trenton	72	14	38.2	1.74					
Watkins	72	10	37.1	1.93					
Waynesborough	72	18	39.5	3.27					
<i>Texas.</i>									
Austin	79	26	54.4	5.02					
Baird				2.18					
Belton†	77	18	50.9	2.89					
Brady†	77	15	47.9	1.57					
Brazoria†	74	35	50.3	2.55					
Brenham†	75	27	50.3	3.94					
Brownwood†	76	18	48.0	2.55					
Camp Eagle Pass	86	33	56.7	2.55					
Camp Pena Colo†	67	18	42.5	4.40					
Gleburne	76	20	47.4	4.45					
College Station	74	24	51.5	2.29					
Colorado	54	14							
Columbia Station†	75	35	55.9	0.83					
Comanche*	75	20	49.8	2.75					
Corsicana (1)	77	19	51.0	4.35					
Corsicana (2)				4.72					
Decatur	73	16	44.4	1.67					
Edinburgh†				1.52					
Forestburgh				1.62					
Fort Bliss	76	18	47.4	0.28					
Fort Brown	89	44	62.6	2.51					
Fort Clark	84	25	50.1	0.83					
Fort Concho	61	17	50.1	2.57					
Fort Davis	68	23	45.8	0.52					
Fort Elliott	75	3	37.4	0.89					
Fort Hancock	83	10	47.2	0.44					
Fort McIntosh	87	37	58.9	2.20					
Fort Ringgold	95	38	61.5	2.62					
Fort Worth†	79	19	47.0	3.92					
Gainesville	75	14	43.9						
Gallinas†	85	31	54.3	4.33					
Granbury*†	76	20	43.2	3.53					
Houston	77	30	55.2	3.32					
Huntsville†	80	28	53.6	2.14					
Ingersoll†	26	25	42.4	3.00					
La Grange†	26	25	55.7	3.79					
Lampasas†	87	24	51.3	3.41					
Longview†	80	26	50.6	3.95					
Luling†	74	30	53.2	3.67					
Measquite†	78	18	47.5	2.62					

Table of miscellaneous meteorological data for February, 1889—Signal Service observations.

Stations and districts.	Elevation above sea level, feet.	Pressure, in inches.		Temperature of air, in degrees Fahrenheit.							Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal precipitation.	Total movement, miles.	Prevailing direction.	Wind.			Cloudless days.	Partly cloudy days.	Cloudy days.	Days with rainfall.	Average cloudiness, tenths.	Length of record, years.	Temperature data since opening of station.							
		Mean actual.	Mean reduced.	Monthly range.	Monthly mean.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.							Greatest daily range.	Least daily range.	Maximum velocity.							Direction.	Date.	Absolute maximum.	Year.	Absolute minimum.	Year.		
<i>New England.</i>																																	
Eastport	53	29.96	30.02	1.49	24.6	-3.2	45	26.2	-12	13.7	32	3	13.2	73.8	4.13	+0.04	8,574	nw.	48	e.	18	11	6	11	12.4	8.4	16	40	1886	-20	1876		
Portland	99	29.93	30.04	1.50	20.3	-5.7	42	27.8	-8	12.8	31	4	11.8	71.8	2.74	-0.03	8,537	n.	33	s.	5	7	7	14	12.5	4.4	6	18	58	1880	-10	1886	
Northfield	871	29.06	30.08	1.44	11.6	-11.0	48	22.0	-32	1.2	50	7	4.0	76.6	2.18	-0.03	6,166	s.	40	sw.	19	3	9	16	16.6	2.5	4	48	1889	-32	1889		
Manchester	247	29.80	30.08	1.61	20.7	-10.0	39	29.5	-9	11.9	31	6	12.6	75.0	1.71	-0.02	4,607	nw.	26	nw.	*	6	16	4	10.4	3.3	9	54	1888	-11	1888		
Boston	125	29.94	30.08	1.56	25.0	-2.0	39	33.0	-1	19.0	33	4	17.2	72.1	1.54	-2.22	8,106	w.	38	sw.	*	6	13	9	12.5	2.3	6	19	64	1880	-7	1886	
Nantucket	14	30.07	30.08	1.45	27.9	-0.0	48	33.9	4	21.9	25	4	24.0	85.7	4.23	-0.00	8,800	nw.	36	*	23	10	8	10	12.6	5.4	5	53	1887	-1	1888		
Wood's Holl	22	30.08	30.10	1.47	27.0	-0.0	46	32.9	2	21.1	25	3	20.1	78.2	4.39	+0.97	11,876	nw.	50	w.	6	13	7	8	12.4	8.3	3	11	53	1880	-5	1875	
Vineyard Haven	26	30.09	30.12	1.46	27.0	-0.0	45	32.3	2	19.5	34	10	22.4	80.8	1.57	-4.25	12,492	nw.	44	nw.	*	8	11	9	10.4	7.4	6	9	54	1887	-1	1886	
Block Island	22	30.00	30.12	1.38	26.8	-2.4	47	35.9	-3	17.8	35	9	16.0	73.1	2.08	-2.33	5,613	nw.	30	w.	*	10	8	10	11.5	3.4	7	7	53	*	-6	1886	
Narragansett Pier	107	30.00	30.12	1.38	27.2	-2.8	46	34.2	1	20.3	26	4	18.6	71.3	2.47	-1.79	5,553	w.	30	nw.	1	12	8	8	12.5	0.4	2	17	62	1880	-6	1871	
New Haven	47	30.05	30.10	1.43	21.3	-5.6	43	27.4	-5	13.5	28	4	14.2	78.6	1.81	-0.79	4,233	nw.	36	w.	*	19	3	15	7	12.6	8.5	8	16	58	1880	-18	1875
<i>Mid. Atlantic States.</i>																																	
Albany	85	30.08	30.12	1.48	20.4	-5.6	43	27.4	-5	13.5	28	4	14.2	78.6	1.81	-0.79	4,233	nw.	36	w.	*	19	3	15	7	12.6	8.5	8	16	58	1880	-18	1875
New York City	185	29.95	30.16	1.39	28.0	-4.0	50	34.5	-2	21.4	26	4	19.8	76.0	3.07	-0.73	8,503	w.	48	*	1	17	10	12	12.4	9.5	1	15	69	1874	-4	1873	
Harrisburg	361	29.78	30.19	1.18	25.2	-4.0	44	31.2	-1	19.2	21	3	17.7	73.3	1.48	-0.00	6,005	nw.	36	nw.	23	9	5	14	9.6	4.5	7	1	44	1889	-1	1889	
Philadelphia	117	30.05	30.18	1.41	29.5	-6.5	51	35.9	-2	21.3	22	5	18.6	68.6	2.00	-1.29	7,415	nw.	36	nw.	*	3	12	13	10.6	3.4	6	19	75	1874	-2	1886	
Atlantic City	34	30.14	30.17	1.37	29.5	-4.5	48	36.5	2	22.5	27	4	22.5	75.8	2.32	-1.14	7,196	w.	34	*	*	6	14	8	7.5	4.3	9	71	1880	-5	1875		
Baltimore	76	30.10	30.19	1.31	30.8	-6.2	48	36.8	3	24.8	25	4	17.8	64.4	2.53	-1.00	3,808	nw.	34	*	*	8	12	11	11.6	5.5	0	17	78	1874	-1	1880	
Washington City	103	30.05	30.19	1.30	31.1	-5.9	54	37.5	4	24.7	26	5	19.6	69.2	2.47	-0.83	3,885	nw.	27	nw.	1	7	10	11	7.6	3.4	5	19	78	1874	-2	1886	
Cape Henry	658	29.46	30.20	1.16	39.7	-4.3	71	47.6	16	31.8	35	7	24.6	72.9	3.06	-0.42	3,171	nw.	36	nw.	5	5	10	13	11.6	4.9	16	74	1874	1	1886		
Lynchburg	69	30.11	30.18	1.24	38.2	-6.8	71	45.0	16	31.3	27	5	27.2	69.8	3.21	-0.46	6,145	n.	48	w.	1	6	10	12	9.6	3.5	8	19	81	1871	4	1886	
<i>S. Atlantic States.</i>																																	
Charlotte	808	29.31	30.19	1.10	39.4	-7.6	69	48.9	13	30.0	30	4	27.5	70.5	4.59	+0.16	4,035	sw.	24	*	*	8	12	8	7.5	3.3	2	11	76	1883	6	1886	
Hatteras	11	30.16	30.18	1.13	43.6	-3.4	67	48.1	22	39.0	20	3	38.2	82.7	4.52	-0.09	11,559	n.	52	nw.	1	8	6	14	8.5	8.5	0	9	71	1884	13	1886	
Kitty Hawk	375	29.78	30.20	1.15	41.2	-3.8	69	49.1	18	33.4	28	5	28.7	73.6	2.82	-1.23	3,069	n.	20	sw.	18	8	8	12	8.5	9.5	2	3	72	1887	13	1889	
Raleigh	375	29.78	30.20	1.15	38.2	-3.8	68	45.8	13	30.5	29	4	28.7	73.6	3.36	-0.00	3,069	nw.	20	sw.	18	8	8	12	8.5	9.5	2	3	72	1887	13	1889	
Southport	52	30.13	30.19	1.04	44.4	-5.4	61	51.0	20	38.3	25	4	34.7	75.2	4.66	+1.29	5,024	sw.	36	sw.	18	8	5	15	10.6	2.5	4	19	81	1880	10	1886	
Wilmington	52	30.13	30.19	1.04	44.4	-5.4	61	50.8	20	38.1	24	3	34.7	75.2	4.66	+1.29	5,024	sw.	36	sw.	18	8	5	15	10.6	2.5	4	19	81	1880	10	1886	
Charleston	52	30.14	30.19	0.93	47.4	-7.6	70	53.8	26	40.9	24	3	38.6	78.2	4.54	+1.02	6,536	sw.	36	sw.	18	4	10	14	12.7	3.6	16	80	1887	13	1886		
Columbia	183	30.04	30.23	0.99	44.0	-7.0	70	53.0	18	35.0	30	8	33.5	71.2	5.75	-1.99	3,428	n.	25	ne.	21	8	10	10	9.9	5.5	2	70	*	18	1889		
Augusta	87	30.11	30.20	0.85	48.0	-8.0	81	55.3	24	40.7	26	3	40.0	79.3	3.92	-0.78	5,125	nw.	26	ne.	21	6	8	14	10.8	1.5	19	81	1889	19	1886		
Savannah	43	30.16	30.21	0.68	53.4	-8.6	81	60.2	31	44.5	32	5	45.0	82.8	3.85	-0.58	3,895	*	25	ne.	21	3	7	15	13.7	6.6	7	18	84	1887	24	1886	
Jacksonville	32	30.17	30.19	0.61	54.0	-7.0	70	59.6	34	48.3	24	3	46.9	82.4	3.35	-0.28	7,345	ne.	37	nw.	11	6	10	13	11.6	4.5	9	10	79	1883	26	1886	
<i>Florida Peninsula.</i>																																	
Cedar Keys	28	30.12	30.15	0.46	64.8	-3.6	82	71.9	45	57.6	23	5	59.4	84.8	4.16	-0.68	6,310	nw.	24	*	13	8	7	11.4	8.4	5	2	85	1888	45	1889		
Jupiter	28	30.12	30.15	0.46	64.8	-3.6	82	71.9	45	57.6	23	5	59.4	84.8	4.16	-0.68	6,310	nw.	24	*	13	8	7	11.4	8.4	5	2	85	1888	45	1889		
Key West	28	30.12	30.15	0.46	64.8	-3.6	82	71.9	45	57.6	23	5	59.4	84.8	4.16	-0.68	6,310	nw.	24	*	13	8	7	11.4	8.4	5	2	85	1888	45	1889		
Mico	12	30.19	30.20	0.52	60.3	-8.3	85	68.4	39	52.2	25	9	57.0	87.0	1.65	-0.40	6,407	nw.	36	n.	19	6	9	13	14.6	5.6	1	1	85	1889	38	*	
Titusville	12	30.19	30.20	0.52	60.3	-8.3	85	68.4	39	52.2	25	9	57.0	87.0	1.65	-0.40	6,407	nw.	36	n.	19	6	9	13	14.6	5.6	1	1	85	1889	38	*	
<i>Western Gulf States.</i>																																	
Atlanta	1,139	28.99	30.21	0.85	41.5	-6.5	75	49.9	14	33.1	28	5	29.2	70.2	5.28	+0.15	7,314	nw.	36	nw.	18	9	10	9	8.5	8.4	6	11	75	1889	8	1885	
Pensacola	50	30.14	30.20	0.68	51.9	-5.1	70	58.6	29	45.2	25	4	43.8	78.7	3.93	-1.20	6,588	ne.	35	sw.	16	4	11	13	11.6	8.4	9	10	78	1883	20	1886	
Mobile	35	30.19	30.23	0.72	50.9	-5.1	70	58.6	29	45.2	25	4	43.8	78.7	3.93	-1.20	6,588	ne.	35	sw.	16	4	11	13	11.6	8.4	9	10	78	1883	20	1886	
Montgomery	217	29.96	30.22	0.79	48.2	-5.8	80	56.6	31	39.8	30	6	36.2	66.8	3.49	-0.97	4,083	w.	24	n.	18	5	9	14	8.7	1.5	3	17	81	1884	14	1886	
Vicksburg	222	29.96	30.20	0.87	49.4	-4.6	79	58.1	24	40.8	31	7	36.2	66.8	3.49	-0.97	4,083	w.	24	n.	18	5	9	14	8.7	1.5	3	17	81	1884	14		



Table of miscellaneous meteorological data for February, 1889—Signal Service observations—Continued.

Stations and districts.	Elevation above level, feet.	Pressure, in inches.		Temperature of air, in degrees Fahrenheit.										Wind.				Cloudless days.				Days with rainfall.		Average cloudiness, tenths.		Length of record, years.		Temperature data since opening of station.			
		Mean actual.	Mean reduced.	Monthly range.	Monthly mean.	Departure from normal.	Maximum.	Mean Maximum.	Minimum.	Mean minimum.	Greatest daily range.	Least daily range.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal precipitation.	Total movement, miles.	Prevailing direction.	Maximum velocity.		Cloudless days.	Partly cloudy days.	Cloudy days.	Days with rainfall.	8 a. m. s. p. m.	Average cloudiness, tenths.	Length of record, years.	Absolute maximum.	Year.	Absolute minimum.	Year.
																			Miles per hour.	Direction.											
<i>Ex. northwest—Con.</i>																															
Bismarck	1,681	28.29	30.20	1.29	10.7	+1.7	48	20.5	-34	0.9	49	3	6.2	88.0	1.48	+0.86	7,331	nw.	56	n.	4	5	15	9	8.5	1.6	1	60	*	-43	1887
Fort Buford	1,900	28.04	30.17	1.31	13.2	+4.2	51	23.6	-32	2.8	39	6	8.8	85.4	0.30	-0.16	6,356	nw.	52	n.	4	5	11	12	8.5	1.6	6	57	1882	-41	1887
Fort Yates	1,423	28.04	30.17	1.31	14.3	+5.3	52	25.5	-25	3.1	50	7	.....	.....	1.00	-0.45	.....	nw.	.....	.....	.....	.....	.....	.....	.....	.....	7	58	1886	-39	1884
<i>Upper Miss. Valley.</i>																															
Saint Paul	831	29.20	30.16	1.70	10.2	-5.8	50	19.9	-25	-0.4	46	7	5.7	85.4	0.31	-0.64	4,325	w.	29	w.	22	7	13	8	9.5	2.5	2	59	1880	-33	1885
La Crosse	744	29.35	30.19	1.58	12.0	-8.0	43	20.3	-23	3.6	35	4	2.2	82.8	0.93	-0.15	5,202	n.	36	n.	4	7	13	8	10.6	1.5	2	65	1882	-34	1875
Davenport	615	29.48	30.18	1.38	20.0	-6.0	45	28.1	-12	11.9	33	7	12.8	76.8	1.44	-0.28	5,990	nw.	35	sw.	21	11	6	11	10.5	0.4	1	67	1882	-21	1888
Des Moines	866	29.23	30.21	1.55	21.0	-2.0	52	31.1	-13	11.0	34	9	10.1	68.0	0.27	-1.18	5,755	n.	35	n.	4	9	9	10	6.5	5.4	3	61	1880	-23	1883
Dubuque	665	29.42	30.18	1.49	17.4	-4.6	45	25.2	-16	9.5	30	6	10.6	79.6	1.34	-0.29	3,725	nw.	24	n.	4	10	9	9	8.5	3.4	7	67	1882	-31	1875
Keokuk	618	29.52	30.21	1.36	14.6	-4.4	42	33.8	-8	15.5	36	7	16.2	77.8	0.90	-1.02	6,526	n.	35	n.	4	8	12	9	8.4	1.4	6	69	1882	-18	1886
Cairo	359	29.81	30.21	1.36	35.6	-4.4	70	43.0	-6	28.2	31	4	24.3	68.8	1.57	-2.57	6,198	n.	36	n.	4	8	12	11	11.5	8.5	9	74	1883	-3	1886
Springfield, Ill.	644	29.48	30.20	1.34	25.4	-7.6	56	33.7	-5	17.1	30	5	16.2	73.4	1.64	-2.53	7,336	nw.	36	n.	5	7	10	11	9.5	4.5	2	72	1882	-11	1885
Saint Louis	571	29.57	30.21	1.28	31.4	-4.6	69	40.3	0	22.5	35	7	23.0	76.2	0.78	-1.87	8,553	nw.	48	sw.	4	10	9	9	9.4	3.4	3	74	1887	-8	1886
<i>Missouri Valley.</i>																															
Springfield, Mo.	1,356	28.69	30.19	1.08	32.6	-3.5	65	41.7	-1	23.4	31	4	24.3	79.4	4.38	.....	6,804	nw.	36	n.	4	9	11	8	10.4	2.4	1	71	*	-2	1883
Leavenworth	842	29.30	30.22	1.33	27.5	-3.5	66	36.2	-5	18.8	34	3	19.6	78.9	2.56	+1.08	4,940	nw.	34	n.	4	10	9	9	7.4	7.5	0	73	1876	-16	1885
Topeka	1,113	28.99	30.23	1.41	26.8	-1.0	69	39.5	-13	14.1	38	4	13.6	73.6	0.23	-0.57	6,776	nw.	49	n.	4	6	10	12	8.1	.....	2	69	1889	-13	1889
Omaha	1,113	28.99	30.23	1.41	23.0	-1.0	53	32.6	-10	13.5	38	6	13.6	73.6	0.23	-0.57	6,776	nw.	49	n.	4	6	10	12	3.4	2.5	1	76	1880	-25	1883
Crete	2,613	27.34	30.22	1.05	23.9	-1.0	52	35.1	-16	12.7	36	11	11.7	71.6	0.15	.....	6,252	n.	60	n.	4	14	3	11	3.4	1.4	1	66	1888	-15	1888
Valentine	1,600	28.39	30.19	1.25	15.0	+5.0	47	24.6	-22	5.4	45	2	8.6	77.4	0.46	+0.18	6,552	n.	66	n.	4	12	7	9	7.4	3.4	6	67	1882	-30	1875
Fort Sully	1,307	28.72	30.20	1.55	10.6	-1.4	45	21.2	-30	0.1	47	6	4.4	77.9	0.93	+0.46	7,192	nw.	60	n.	4	12	8	8	9.5	4.3	7	68	1886	-32	1888
Huron	1,234	28.82	30.20	1.48	18.4	-0.6	56	28.8	-18	8.1	44	4	9.2	72.8	0.20	-0.58	5,781	nw.	60	n.	4	13	9	6	8.3	3.3	8	68	1876	-25	1886
Yankton	947	29.16	30.24	1.28	28.2	-0.8	65	36.6	-4	20.4	33	5	2.0	74.5	1.91	.....	5,672	n.	32	n.	4	10	4	14	7.4	3.5	0	65	1889	-4	1889
<i>Kansas City.</i>																															
Fort Assinaboine	2,720	27.25	30.18	0.92	21.8	-8.8	62	31.6	-22	12.1	51	5	12.0	70.4	0.45	-0.20	7,721	sw.	72	n.	12	8	5	15	8.5	3.5	4	63	1886	-55	1887
Fort Custer	3,040	26.92	30.20	1.03	21.4	-0.4	54	30.7	-24	12.1	40	2	12.8	76.0	0.56	+0.08	5,403	se.	66	n.	3	7	8	13	10.5	8.5	5	64	1881	-38	1883
Fort Maginnis	4,340	25.57	30.12	0.71	21.2	-3.2	54	30.0	-28	12.4	33	6	13.2	69.8	1.39	-0.03	9,849	n.	56	n.	11	5	12	11	11.4	5.4	5	70	1886	-42	1888
Helena	4,069	25.89	30.19	0.76	25.2	-4.2	61	34.5	-15	15.9	31	8	14.5	71.2	0.72	+0.09	4,671	n.	38	w.	3	10	6	12	6.4	3.5	4	62	1886	-40	1887
Poplar River	2,030	27.94	30.17	1.30	17.0	+16.0	58	38.6	-34	5.3	43	9	9.8	82.2	0.15	-0.36	5,176	w.	55	n.	21	3	13	12	5.5	9.5	5	50	1886	-50	1885
Rapid City	3,280	26.63	30.19	1.00	21.1	-1.0	58	31.5	-17	10.7	37	7	13.4	76.0	1.39	+0.09	6,224	n.	52	n.	4	7	9	12	10.3	6.5	6	65	1882	-40	1883
Cheyenne	6,105	23.95	30.15	0.82	24.8	-1.2	54	35.6	-16	14.0	46	7	7.2	56.1	0.62	+0.34	9,242	n.	50	n.	4	3	14	11	6.3	5.4	8	63	1886	-28	1884
Fort Laramie	2,841	27.15	30.20	1.07	24.2	-1.6	54	33.3	-19	10.2	49	10	13.2	66.7	0.07	-0.30	6,310	n.	48	n.	4	6	18	4	3.4	1.4	7	65	1886	-22	1887
North Platte	2,841	27.15	30.20	1.07	24.2	-1.6	54	33.3	-19	10.2	49	10	13.2	66.7	0.07	-0.30	6,310	n.	48	n.	4	6	18	4	3.4	1.4	7	65	1886	-22	1887
Fort McKinney	2,841	27.15	30.20	1.07	24.2	-1.6	54	33.3	-19	10.2	49	10	13.2	66.7	0.07	-0.30	6,310	n.	48	n.	4	6	18	4	3.4	1.4	7	65	1886	-22	1887
Fort Washakie	5,580	24.44	30.20	0.87	16.4	-2.8	59	34.3	-14	13.4	34	8	14.6	72.8	0.81	.....	7,027	n.	60	n.	4	8	16	4	8.3	9.4	1	58	1889	-54	1889
<i>Middle slope.</i>																															
Colorado Springs	5,281	24.73	30.13	0.84	29.6	-1.4	61	42.0	-7	17.3	42	13	12.6	61.1	0.60	+0.16	4,690	n.	36	n.	11	11	6	6	7.2	8.4	2	64	1888	-8	1889
Denver	4,724	25.27	30.13	0.84	31.2	-1.2	65	46.1	-8	16.2	48	2	11.6	54.4	0.24	.....	4,279	e.	36	w.	4	13	9	6	6.4	0.4	6	72	1879	-22	1883
Pueblo	1,384	28.69	30.22	1.34	26.2	-1.8	60	35.5	-7	16.8	31	6	16.9	77.0	0.59	-0.10	4,987	n.	46	n.	4	11	11	6	6.3	4.3	4	72	1887	-15	1887
Concordia	2,523	27.49	30.22	1.24	29.0	-2.0	60	40.1	-8	18.0	36	3	17.1	71.3	0.34	-0.21	6,413	ne.	58	n.	4	8	10</								

## NOTES AND EXTRACTS.

## THE MEASUREMENT OF WIND VELOCITY.

[By C. F. MARVIN, Asst. Prof., Signal Service.]

Since the invention of the excellent instrument known as the Robinson anemometer, now so universally used by meteorologists for determining the wind movement, various scientists have endeavored to develop mathematically its theory, and to determine experimentally its constants, or the factors by which the wind movement is computed from the velocity of the cups. As a first approximation to the solution of what has proved to be a very difficult problem, the inventor concluded, after a study in which both theoretical consideration and experimental results were combined, that, in general, *the wind moved just three times as fast as the centre of the cups of the anemometer*. This relation has been widely accepted and long used as the true one, and was adopted by the Signal Service early in its history as the proper factor for its standard anemometer.

The instrument is so well known that a very brief description is sufficient; and the dimensions given are those of the Signal Service standard. A vertical spindle, very nearly a foot long, has, fastened to its upper end, a horizontal cross, consisting of four small steel arms, radiating from the centre and arranged at right-angles to each other. On the outer end of each arm is fixed a thin, metal, hemispherical cup, 4 inches in diameter; its centre being 6.72 inches from the centre of the cross, or axis of revolution. The circular rims of the hemispherical cups have their planes vertical, and the front or concave sides of the cups face in the same direction around the axis of rotation. The vertical spindle is supported in suitable bearings, and is provided at its lower end with an endless screw which gives motion to a train of wheels by which the revolutions of the spindle are registered. This anemometer (with a factor 3) is presumed to make 500 revolutions of its cups for each mile of wind movement, and the dials are graduated and numbered in accordance with this supposition.

Mathematical analysis has failed to develop in useful form the law for the anemometer, and the results of experiments, as made by various investigators, disagree with each other to such an extent that it is impossible to tell which are correct. This is doubtless due to the unfavorable conditions, in many respects, under which the experiments are necessarily made, and the imperfect and unequal elimination of the effects of various disturbing circumstances to which all experiments are subject.

The method of experiment that has been attended with the greatest measure of success has been to whirl the anemometer through still air at a known velocity and measure the velocity of its cups, from which, when the experiment is repeated at several widely different velocities, the law of the anemometer is worked out. In order to whirl the anemometer conveniently, it is placed on the end of a long horizontal arm that is properly balanced upon, and adapted to revolve about, a vertical axis. The use of such whirling arms is always attended with certain complications, in consequence of which the results obtained are known to be more or less in error, and the amount of this error is very uncertain and difficult to determine. It is quite a necessity that all these experiments be made in a closed room; though in several cases investigations have been carried on in the open air, the most recent of which are those made in England by the wind-force committee of the Royal Meteorological Society. Under such circumstances the problem becomes still more complicated, as the natural wind blowing past the anemometer is rarely or never so small that its effect can be ignored, nor can it be readily determined. In this latter respect, it can be shown that, leaving other things out of account, the effect of a natural uniform wind is to make the cups go faster than they otherwise would. A uniform wind, however, in nature is an anomaly, so that the error for this condition is quite beyond accurate determination. In fact, the results of all open air experiments on whirling machines can be considered as only coarsely approximate.

\*The largest machines heretofore used in closed rooms have had arms less than 14 feet from the centre to the axis of the anemometer. As the various unavoidable errors are, in nearly all cases, larger in proportion as the whirling arm is shorter, the best results are to be expected by the use of very long arms.

Finding it very unsatisfactory to attempt to determine the anemometer constants from the experiments already made, the Chief Signal Officer directed a new investigation to be made, in which it was endeavored to profit by the experience of all previously engaged in such work, and before passing to a description of the details of the methods used in these experiments, or the results, it will be well to consider some of the more important difficulties and sources of error to be encountered.

The anemometer on the whirling machine operates under a variety of conditions that are essentially different from its circumstances in the open air:

(1.) On the whirler it is itself in motion in stationary air, while when in use the anemometer is stationary in moving air. We cannot see why there should be any difference in the results for these two conditions, and, in the absence of experimental evidence to the contrary, we are rather forced to make the seemingly natural assumption that there is no sensible difference.

(2.) On the whirler the anemometer is constrained to move in a circular path, and the tendency to fly off from this path is accompanied by increased pressure of the spindle in its bearings, the result of which is increased friction and possibly slower motion of the cups. When it is considered that, with a whirling arm 14 feet long and the weight of the revolving parts of the anemometer about 1 to 2 pounds, the pressure under which the spindle revolves is seven or eight times the normal pressure in the open air, it seems quite probable that the whirling-machine experiments should be affected in a sensible degree from this extra friction. I am not aware, however, that experiments

have been made to determine this error, it being, in general, passed over with little or no remark.

(3.) Another effect attending the circular motion on the whirling arm arises from the fact that when the spindle of the anemometer is vertical those cups that are nearer the axis of the whirling arm travel at a less velocity and experience less wind than those on the opposite side of the anemometer axis. Now, since the whirling arm can be made to revolve in two directions, while any particular set of anemometer cups will always revolve in the same direction, depending on the manner in which the cups are set upon the cross-arms, and how the latter are attached to the spindle, it results that when the whirler is revolved in one direction the cups that experience the greater velocity will have their concave surfaces presented to the wind, while those that are opposite experience a less velocity and present their convex surfaces to the wind. In such a case the cups will run faster than for normal conditions of equally distributed wind, or, in other words, for motion in a straight line. The case is exactly reversed when the motion of the whirling arm is reversed, and under these conditions the anemometer runs slower than its normal rate, or its rate for straight-line motion. It is considered that the mean of results obtained for the two directions of rotation of the whirling arm gives the value that would have been found had the motion of the anemometer axis been along a straight line instead of a circle. No experiment, therefore, in which the axis of the anemometer is perpendicular to the plane of revolution of the whirling arm, is complete, unless the results are taken for rotating the arm in opposite directions. No attention seems to have been paid to this consideration in the experiments so recently made in England, and all the results (the Robinson factor) are therefore either too high or too low, according to whether the anemometer and whirling arm revolved in the same or in opposite directions, and by an amount depending, in the main, upon the relative lengths of the arms of the anemometer and that of the whirler.

(4.) Still another peculiar effect results from the circular motion of the anemometer, namely: the number of revolutions of the cups, as observed registered by the counting mechanism after a given interval, is not the actual number of turns, but only the number in relation to the whirling arm, which itself may in the meantime have made several revolutions. To find the real number of turns during any time, it is necessary to add or subtract from the apparent number one turn for each revolution made by the whirling arm. This is to be added when the arm and the anemometer revolve in the same direction and to be subtracted for the reverse condition. A knowledge of this fact has led some to suppose that such a correction should be applied to all whirling-machine experiments, but such is not the case, for the reason that, while such a method would give the actual number of revolutions of the anemometer cups in relation to any fixed object, as the floor of the room, for instance, yet, since the direction in which the air acts upon the cups of the anemometer is itself as the arm revolves, continually changing, relative to the fixed object, it follows that the real number of turns of the cups in relation to the air which makes them revolve is, after all, simply the apparent number of turns indicated by the dials. It is therefore erroneous to apply any correction of this kind as one is at first led to suppose.

(5.) The last to be considered as, perhaps, the most serious, and undoubtedly the most difficult to dispose of, is what has been called the "mit-wind." When the arm, including its accessories, is in motion there is a tendency to drag the air around with it, and this movement of the air with the arm prevents the anemometer from experiencing the full quota of wind effect corresponding to the real motion of the arm. Before any correct results can be obtained it is necessary, therefore, to be able to measure to just what extent the air, through which the anemometer passes, fails to remain stationary. The above conception of "mit-wind" is possibly somewhat different from that entertained by others who generally make use of the term when referring to a more or less continuous movement of rotation imparted to the whole mass of air through which the arm revolves. Such a condition undoubtedly exists in no small degree where arms of moderate length are used, especially if they are somewhat stoutly built and expose considerable surface to the air. Even with long arms (30 to 40 feet) the rotation of the air, as a whole, is quite perceptible. In any case it is necessary to know, as previously stated, to just what extent the air, through which the arm passes, fails to be in a stationary condition when met by the anemometer, and hereafter the word "mit-wind" will be used to refer to any motion which the air may have in consequence of the action upon it of the whirling arm and accessories.

The measurement of the "mit-wind" has generally been the most unsatisfactory feature of all experimental investigations. Very delicate and sensitive air-current meters have been set up around the whirling machines and near the path of the anemometer, by which means it was intended to measure the slow rotation of the air, but these meters are so strongly affected by the violent commotion and disturbance that immediately follow the passage of the anemometer that the much slower movement the air may have just before it is met by the anemometer is quite lost, and more or less misleading results only are obtained.

After the above in relation to the whirling machine, and its sources of error, a few remarks upon the anemometer, especially its general law of motion, will not be inappropriate.

Robinson, the inventor, was at first satisfied, that, after neglecting friction, the factor 3 would very closely represent for all velocities how many times faster the wind moved than the cups. Mature consideration will show that neither 3 nor any other single factor can represent, with reasonable accuracy, the relation between the velocities of the wind and that of the centres of the



cups, unless the range of velocities is made very small. Since it is impossible to make an anemometer without friction, and since from the peculiar construction of the instrument the wind acts to produce rotation on only a part of its cups at a time, the action on the remaining cups being in a direction to prevent the above motion, it results that the difference only of the wind pressures is effective in causing rotation, and when the wind is very light this difference in its pressures is insufficient to overcome the friction in the moving parts. It is evident that for this case in which the cups actually remain stationary the velocity of the wind is infinitely greater than that of the cups. In many anemometers a wind velocity of a mile an hour or more is necessary to start the cups, and when they do fairly move in a light wind it will be so slowly that a factor like 3 is not nearly large enough. The faster the wind blows the smaller the factor becomes, so that for high winds the factor 3 is too large. It is quite impracticable, therefore, to represent at all accurately the anemometer law by any single factor, and the next simplest thing that it has been found could be done is to determine, as it were, how fast the wind must blow to just start the cups. This being determined we can next find a single factor such that if we multiply the velocity of the cups by it and then add to the result the velocity necessary to just start the cups, the two together will give a quantity that will, in many cases depending upon the dimensions of the anemometer, quite closely represent the actual wind movement through a considerable range of velocities. A still closer agreement can be obtained by introducing a third term in which the square of the velocity of the cups is multiplied by still another factor.

The experiments then, such as have been indicated, are made in order to furnish data from which factors, like those suggested above, can be computed. The discussion already given of the general law of the anemometer and the sources of error in the whirling machine experiments, will serve to point out various special characteristics that will tend to lead to the most accurate or satisfactory results, thus:

1st. The anemometer must have the smallest amount of friction possible, and its friction must be the same one day that it is another.

2d. The whirling arm must be as long as possible, not only because the effect due to the centrifugal tendency is less, but also because the motion of the anemometer in a very large circle comes more nearly being motion in a straight line, and, moreover, the tendency of a long arm to set the surrounding air in motion, or to generate "mit-wind" is less.

3d. The arm must be made as slender as possible, as this also will favor the development of only a little "mit-wind."

With these general characteristics in view, an anemometer spindle was constructed, the upper end of which was provided with a bearing consisting of a peculiar set of rollers, by which the friction was reduced to a minimum, and but small under the influence of the centrifugal tendency.

The arm of the whirling machine was made of the ordinary wrought-iron pipe, 2½ inches in diameter at the centre and 1½ at the outer end. The length of the arm from the centre to the point at which the axis of the anemometer was carried was 35 feet, but the construction was such that 7 feet could be taken off the outer end, leaving the arm 28 feet long, experiments being made with both lengths. Galvanized-iron telegraph wires of ordinary size (No. 9) were, by means of bolts, drawn very tight over struts at the axis of the arm, which was thus, though very slender itself, made very rigid, and, at the same time, exposed a minimum amount of surface to the air. A short end of the arm opposite the long one carried a heavy counterpoise of iron weights, by which the whole was nicely balanced upon the vertical axis, which turned with great smoothness and freedom in suitable bearings; the height of the arm above the floor was about 8 feet, and the anemometer cups 2 feet higher.

Motion was given by hand-power applied to a horizontal hand-wheel, something like a pilot-wheel, but with the pins set on the side instead of the edge of the wheel. The first intention was to revolve the arm by means of cranks and gearing, but the latter were found to work, even at the best, with sufficient jar to impart a tremulous motion to the slender arm, and were rejected.

The velocity of the arm, as also that of any of the anemometers that might be placed on its outer end, was automatically recorded on a sheet of paper by means of a chronograph, the time being determined from a carefully adjusted seconds-pendulum, which was arranged to momentarily break an electric circuit every swing. In addition to this permanent record, the motion of the arm was, by an ingenious arrangement of electrical devices, made to give an audible indication of its velocity, so that the operator could tell, almost instantly, and with great precision, whether the velocity was higher or lower than the rate desired and so control the driving power as to maintain practically a perfectly uniform motion of the whirler. The rate was not only thus preserved uniform, but, by a slight and conveniently-made change in the devices, they served to regulate the velocity at any of the rates, so that the end of the arm, or more properly the axis of the anemometer, was moved at 2½, 5, 10, 15, 20, and 30 miles per hour.

Through the courtesy of Gen. J. C. Black, Commissioner of Pensions, this large whirler was set up in the west portion of the great court of the Pension Building. The space, which is roofed over and otherwise closed on all sides, is nearly 90 feet square and very high, so that it offers extremely favorable conditions for these experiments.

In order to be able to observe whether the air in the court was perfectly still, as also to note the amount of disturbance set up by the rotation of the arm, several small tissue-paper streamers, suspended by fine threads from cords stretched across the court, were arranged at various points so as to hang a little above the path of the cups of the anemometer. These are very sensitive to slight air currents and proved very useful throughout the experiments.

Many efforts were made to measure the "mit-wind" effect by use of stationary current meters, but without the least success. The following method was finally adopted with most satisfactory results:

A very small and delicate anemometer was constructed, having cups made of small paper cones. These were 1½ inches in diameter at the base, the slant height of the cone being the same, so that the angle at the apex was 60°. The arms to which these cups were attached were 1.47 inches long to the centres of the cups; the weight of these arms and cups was a little less than 2½ grammes, or about half the weight of a nickel 5-cent piece. The spindle of the anemometer was correspondingly delicate, and gave motion to a single wheel which was arranged to break an electric circuit once in each revolution, corresponding to 191 revolutions of the spindle. The part which formed the immediate support for the spindle and wheel work was scarcely as thick as a lead pencil.

Before any use could be made of this anemometer it was necessary to determine its constants. This was done by whirling it upon the machine, but in order to remove it, as far as possible, from any influence of "mit-wind" or other disturbance in the vicinity of the arm, a slender support nearly 10 feet high was erected at the end of the arm and the little anemometer placed upon the upper end of this. Being so small itself as to produce practically no appreciable "mit-wind," and being out of reach of the disturbance due to the arm, it was possible to whirl this anemometer in perfectly still air, especially since, owing to the extreme lightness of its cups, in consequence of which they would almost instantly take up their proper velocity, it was rarely necessary to prolong the motion of the arm for more than 1 to 2 minutes, except for very low velocities. The constants of this anemometer were thus determined repeatedly during the progress of the work.

When using this anemometer while experimenting upon larger ones it was carried just a little below the level of the large anemometer and about 6 feet in front of it, as shown in the illustration. From the record on the chronograph sheet for the small anemometer, it is possible, using the constants previously determined, to calculate just how fast the small anemometer passed through the air, as shown by the motion of its own cups. If there is any "mit-wind" it is at once shown in this way, as the velocity determined from that of the cups will be less than that of the end of the arm, as was the case in every instance, except when experiments were made at certain times during which the outer doors and windows of the court were open, permitting air currents of noticeable velocity to circulate about the court. Experiments were only made at such times to show what would result, and the values obtained were not used in computing the final equations.

In addition to the experiments made with the standard Signal Service anemometer, other instruments in which the cups and arms were of various relative dimensions or of modified form were tested, the results of which will be published later.

Two sets of constants were computed for the Signal Service anemometer and are given below, the first set forms the terms of an equation of a straight line, the second, those of a quadratic equation:

$$V = 0.225 + 3.143v - .0362v^2$$

$$V = 0.994 + 2.739v$$

The degree of closeness with which the true wind velocities can be computed by these equations is indicated in the table below, in which also appear the velocities computed by the old factor, 3:

Wind velocity, miles per hour.	Old factor, 3, gives velocity—	Straight line equation gives velocity—	Quadratic equation gives velocity—
3.....	14 per cent. too small.	13 per cent. too great.	3 per cent. too small.
5.....	8 per cent. too small.	5 per cent. too great.	0.3 per cent. too small.
10.....	2 per cent. too small.	0. K.....	2 per cent. too great.
15.....	0. K.....	2 per cent. too small.	0.1 per cent. too great.
20.....	2 per cent. too great.	2 per cent. too small.	0.1 per cent. too small.
25.....	5 per cent. too great.	0. K.....	0.2 per cent. too small.
30.....	8 per cent. too great.	2 per cent. too great.	0.2 per cent. too great.
*40.....	15 per cent. too great.	5 per cent. too great.	±.

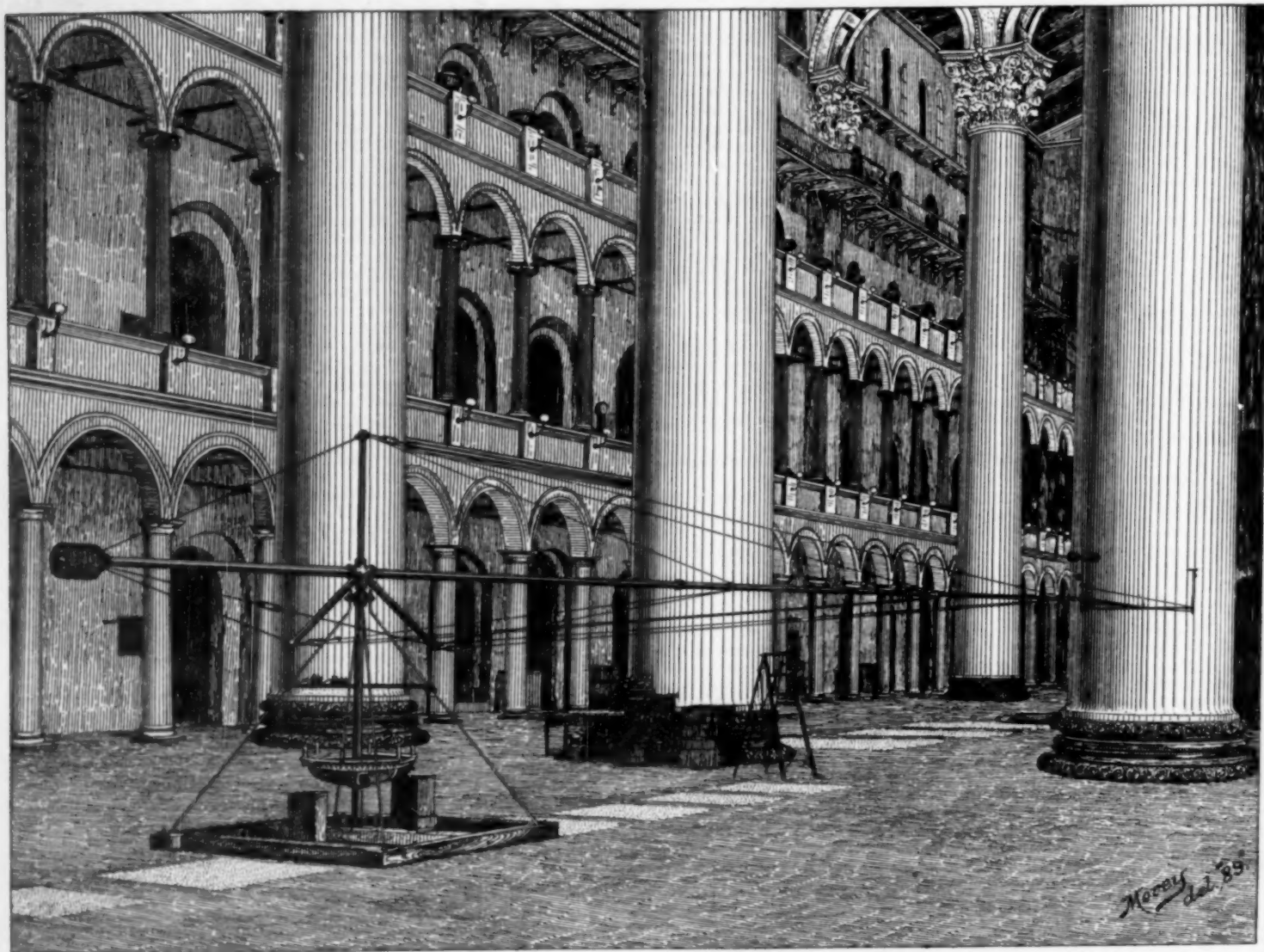
\* This value was computed by means of the quadratic equation.

These constants, it must be remembered, apply to the case of the anemometer being moved forward through still air and at an almost perfectly uniform velocity. In the open air, in addition to the fact that the anemometer is itself stationary, the motion of the air is far from uniform, but is constantly and very suddenly changing, frequently from quite low to quite high velocities. No account seems to have been taken in previous experiments of the questions that arise in this connection, notwithstanding their great importance. The weight of the anemometer cups, of the ordinary size, even when made as light as possible, is sufficient to cause them to continue in motion for a considerable time after a wind which may have started them has ceased. It is argued that for any amount gained in this way a corresponding amount is lost when the wind begins to blow, as at this time the weight of the cups makes them lag behind, but while some compensation is effected in this way, it can be demonstrated that heavy cups in a variable wind run faster than they would in a uniform wind of velocity equal to that of the mean of the variable wind. In recent experiments this gain has amounted to an excess of nearly 10 per cent. in the mean velocity, and even more than 30 per cent. in single instances. By variable velocity in this connection is meant, not a slow change from hour to hour, but the sudden and somewhat violent fluctuations that occur within a minute or even less and are so noticeable on any somewhat windy day.

The results of the open air comparisons are not sufficiently complete, as yet, to warrant further discussion, but it is very evident that the precise action of an ordinary anemometer in a variable wind cannot be completely worked out

by whirling machine experiments at uniform velocities. Experiments are now in progress in which the weight of the cups is varied without changing them materially in other respects, and it is anticipated that much valuable information is to be gained in this way.

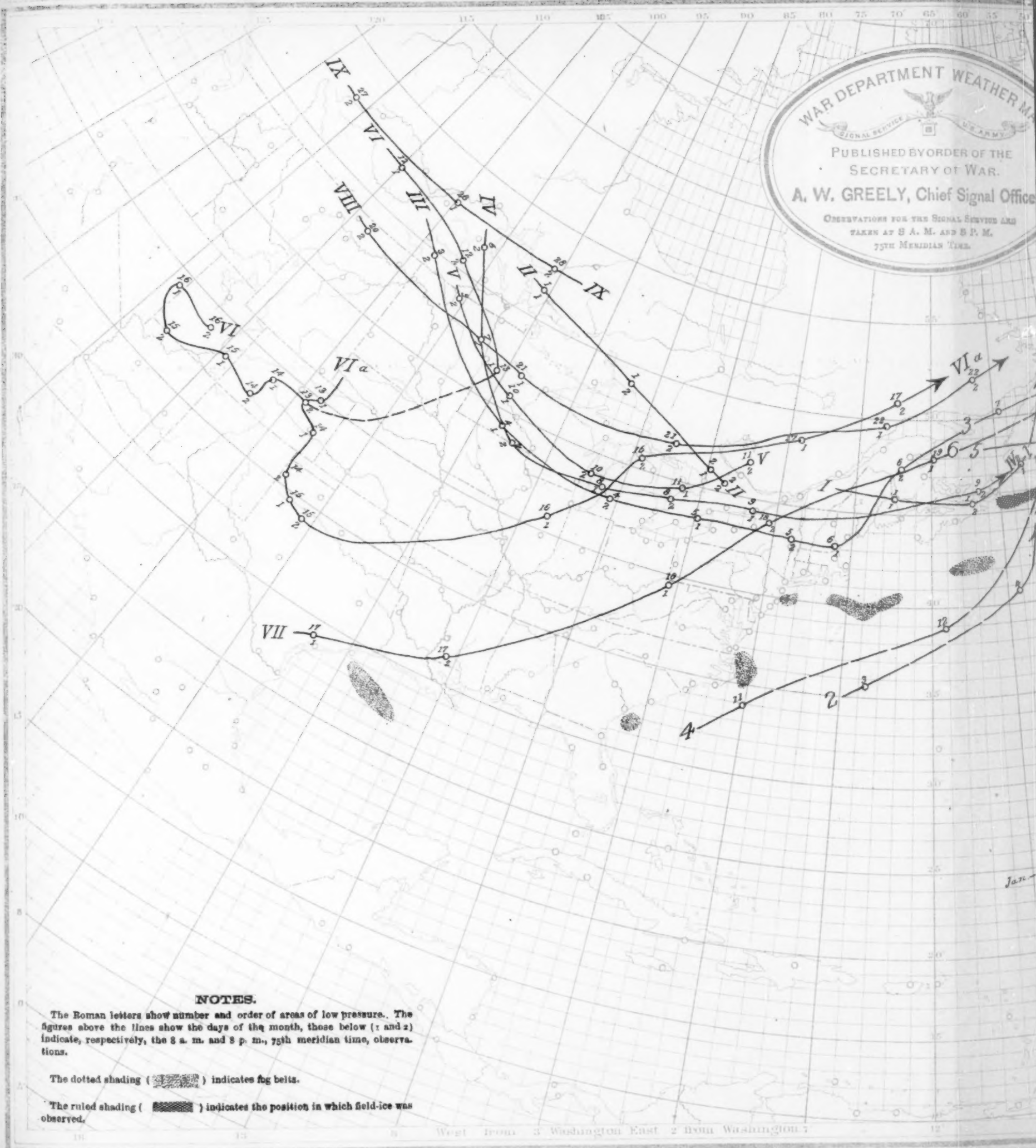
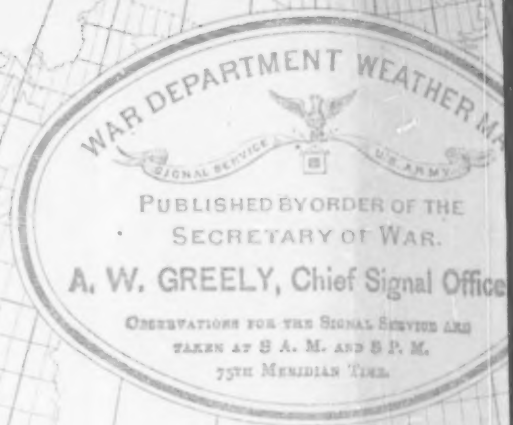
The general appearance of the apparatus and accessories is shown in the accompanying illustration, which is taken from a photograph made during the progress of the work. The arm at this time was 35 feet long.  
WASHINGTON, D. C., February 20, 1889.





# Chart I. Tracks of Areas of Low Pressure.

Form 106-6-1001



## NOTES.

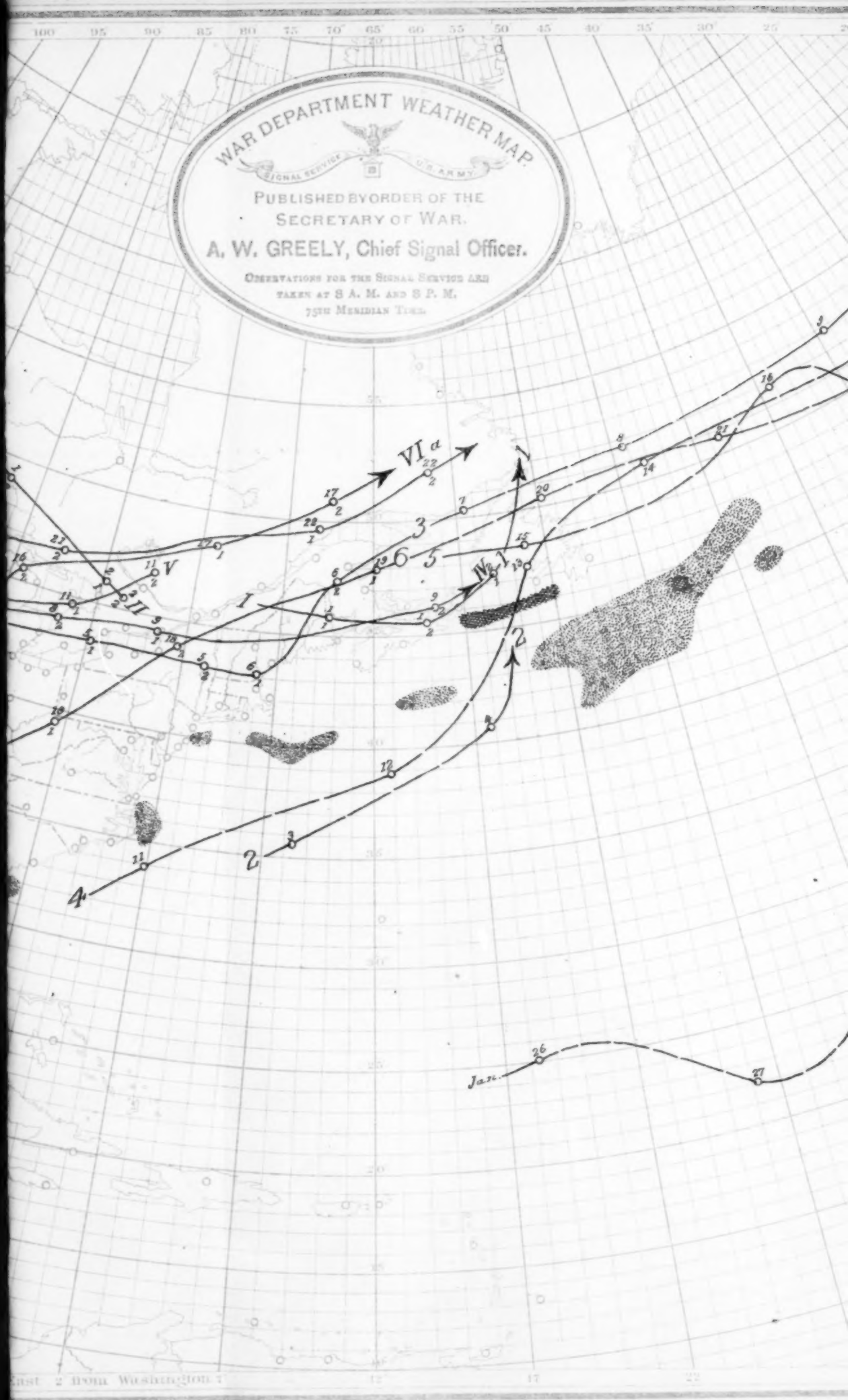
The Roman letters show number and order of areas of low pressure. The figures above the lines show the days of the month, those below (1 and 2) indicate, respectively, the 8 a. m. and 8 p. m., 75th meridian time, observations.

The dotted shading ( ) indicates fog belts.

The ruled shading ( ) indicates the position in which field-ice was observed.

West from 3 Washington East 2 from Washington 1

Chart I. Tracks of Areas of Low Pressure. February, 1889.







Signal Office Ltd.



Chart II. Isotherms, and Winds, February 1889.



Chart II. Isotherms, and Winds, February 1889.



Chart II. Isobars, Isotherms, and Winds, February, 1889.

Form 1041 F.



Chart V. Depth of Snow (inches) on ground February 28, 1889, and Limits of Freezing Weather.

FORM 106 F

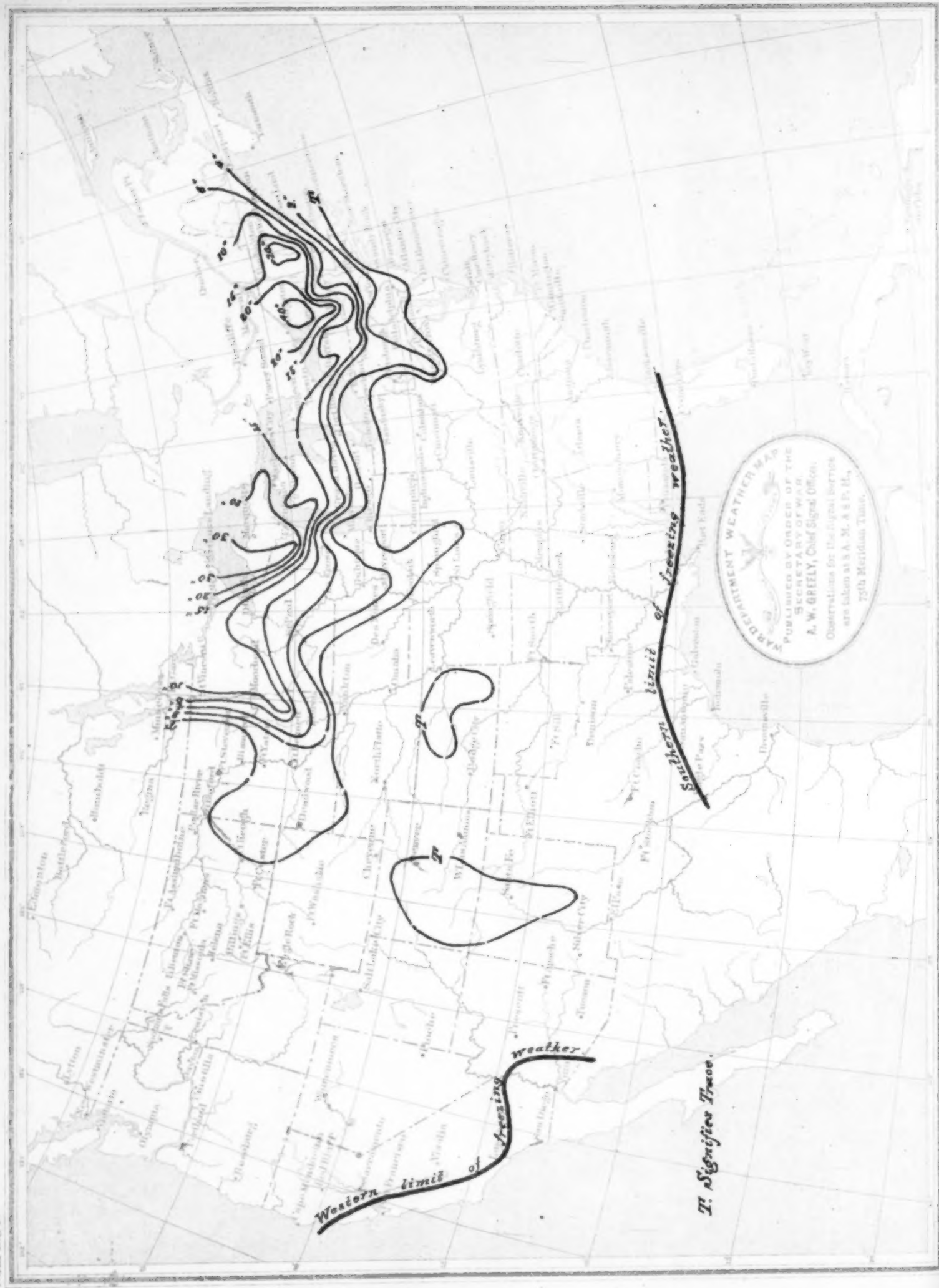




Chart III. Precipitation, February, 1889.

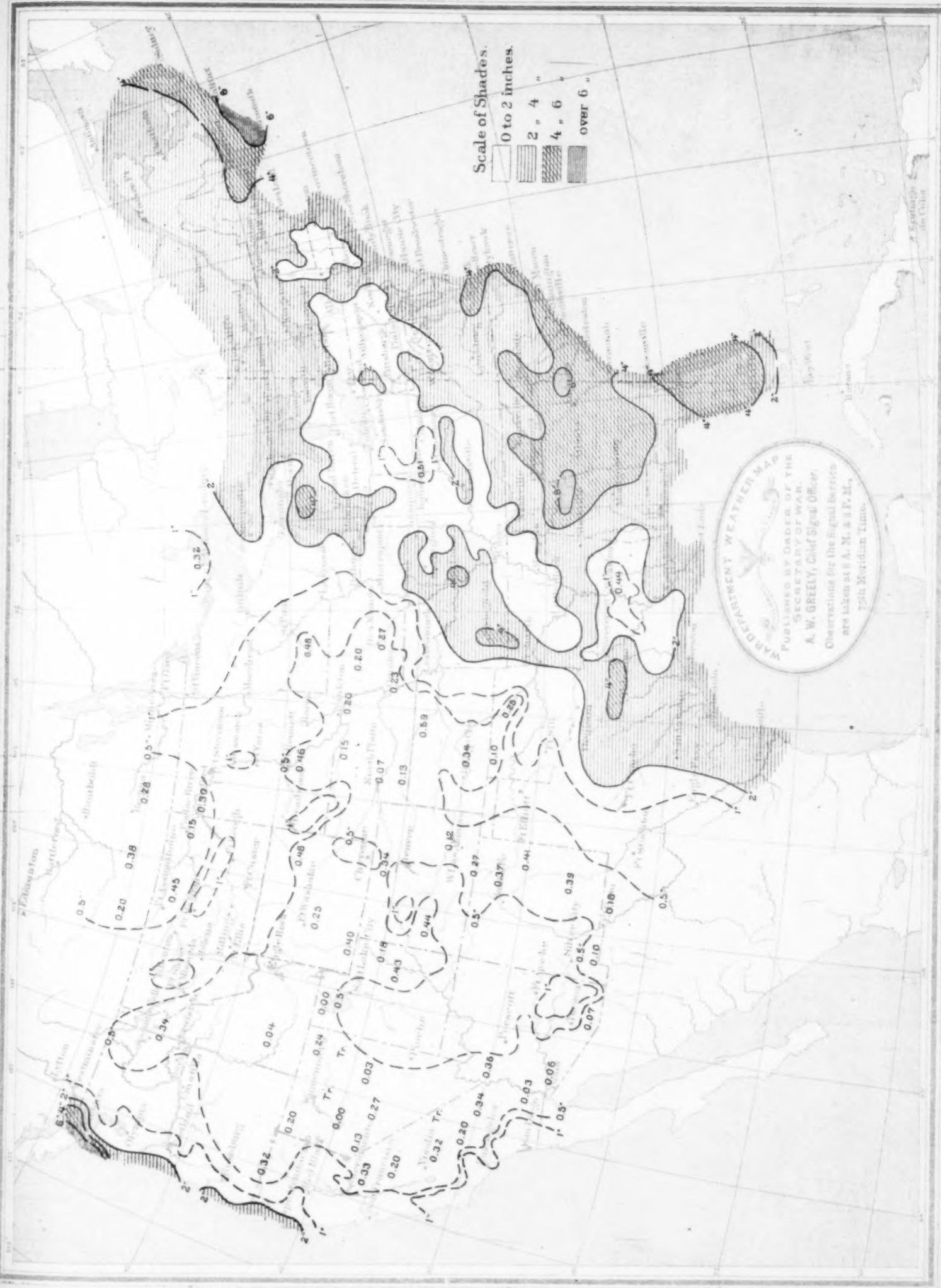
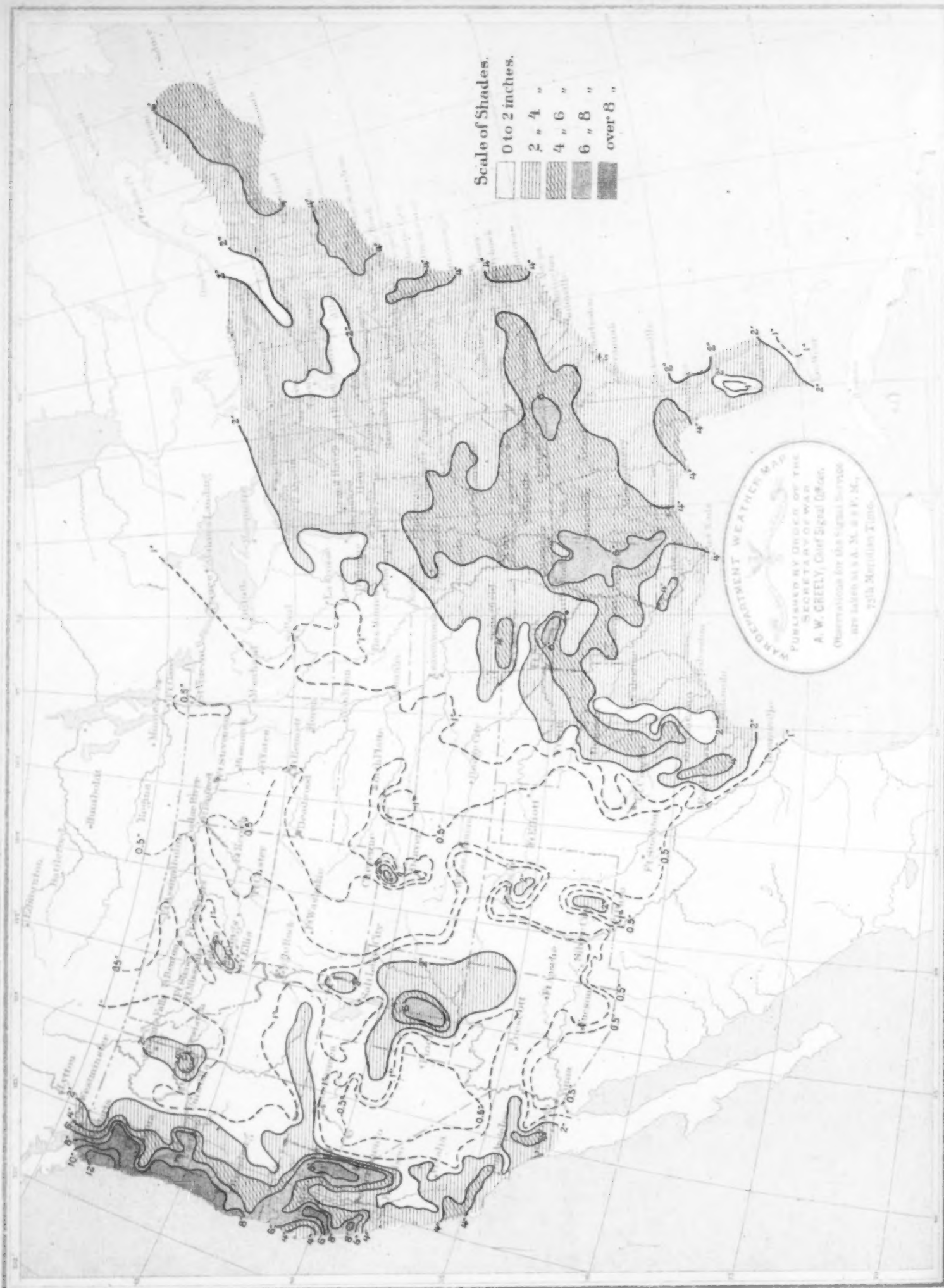


Chart IV. Normal Precipitation for February from 18 years' observations, 1870 to 1888.

Form 106 F



List of

Place

Auburn,  
Bermuda  
Citronelle  
Gadsden  
Livingston  
Motes, A.  
New Mar  
Selma, V.  
Troy, Jas  
Valley Ho

Antelope  
Ash Can  
Banghar  
Cedar Spr  
Eagle Pas  
Flagstaff  
Florence,  
Globe, J.  
Holbrook  
Hualapai  
Phoenix, S  
Prescott J  
Teviston,  
Tucson, E  
Williams,  
Willow Sp  
Winlow,

Lead Hill,  
Little Rock

Anderson,  
Banning, V  
Barstow, C  
Colegrove,  
Georgetown  
Hanford, L  
Hydesville,  
Lewis Cree  
Needles, J  
Nicolaus, A  
Oakland, D  
Orville, H  
Sacramento  
Salinas, Dr  
Santa Barba  
Santa Maria  
Susanville,  
Willow, Da

Bennett, I.  
Colorado  
Conter, Jes  
Delta, J. A.  
Fort Collins  
Georgetown  
Greeley, E.  
Rocky Ford

Hartford, V  
New Hartford  
Southington  
Voluntown,

Brookings, I  
Davenport, V  
Gallatin, S.  
Garden City  
Goddard, M  
Grand View  
Highmore,  
Kimball, A.  
New England  
Parkston, Jo  
Spearfish, J.  
Spring Lake  
Webster, Ar  
Woley, G. V  
Woonsocket,

Newark, Pro  
Kirkwood, W  
Viola, J. A.  
Distributing  
Kendall Gree  
Receiving Re  
Creek E

Monte Sp  
Chas. E  
Meade, A



List of voluntary stations of the Signal Service, with their respective observers, who furnish meteorological reports for the Monthly Weather Review. Those marked with an asterisk (\*) did not send reports in time to be used in Review for February, 1889.

Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.
<b>ALABAMA.</b> Auburn, Alabama Weather Service. Bermuda, Wm. Fowler. Citronelle, J. G. Michael. Gadsden, D. P. Goodhue. Livingston, J. W. A. Wright. Motes, A. M. Weiler. New Market, Dr. Geo. D. Norris. Selma, W. D. Dunlap, Jr. Troy, Jas. Waldaner. Valley Head, E. P. Nicholson, M. D.	<b>FLORIDA—Continued.</b> Homeland, J. S. Wade. Kissimmee, E. E. W. Brewster. Manatee, Mrs. Mary W. Broberg. Matanzas, Mrs. B. E. Dupont. Merritt's Island, Rev. J. H. White. Tallahassee, Rev. Dr. W. H. Carter. Villa City, J. Emory Round. <b>GEORGIA.</b> Andersonville, H. W. Bryant. Athens, Prof. L. H. Charbonnier. Duck, A. L. Gillespie. Forsyth, Thos. G. Scott. Hephzibah, R. L. Rhodes. Marietta, G. S. Owen. Milledgeville, S. A. Cook. Quitman, J. L. Cutler. Thomasville, C. S. Boudurant. <b>IDAHO.</b> Lewiston, Robert Schleicher. <b>ILLINOIS.</b> *Charleston, J. B. Dazey. Collinsville, Dr. J. L. R. Wadsworth. *Jacksonville, P. J. Hasenstab. Mattoon, Wm. Dozier. Mount Morris, Wm. Feary. Oswego, John S. Seely. Palestine, John E. Templeton. Pekin, Rev. J. E. Terborg. *Peoria, Dr. Fred. Brendle. Philo, H. A. Burr. Riley, John W. James. Rockford, T. D. Robertson. Sandwich, Dr. N. E. Ballou. South Evanston, Dr. M. D. Ewell. Springfield, Illinois Weather Service. Sycamore, Roswell Dow. *Windsor, A. H. Hatch. <b>INDIANA.</b> Butler, C. F. Hole. Dana, J. E. Wright. Huntersville, J. E. Hunter. Jeffersonville, J. C. Loomis. *Laconia, L. A. Crozier. La Fayette, Indiana Weather Service. Mauzy, Elwood Kirkwood. New Providence, Prof. E. S. Hallett. *Point Isabel, Jas. F. Hood. Salem, J. W. May. Scenesville, Urias Wilson. Sunman, B. F. Ferris. Vevay, Prof. Chas. Boerner. <b>INDIAN TERRITORY.</b> Caddo Creek, B. Leming, M. D. Jintown, M. M. Yeakley. <b>IOWA.</b> *Albion, Enoch Lewis. Amana, Conrad Schadt. Ames, J. Rush Lincoln. Bancroft, H. N. Renfrew. Blakeville, James Rogers. Cedar Rapids, H. D. Olds. Clarinda, A. S. Van Sandt. *Clinton, Luke Roberts. Cresco, Gregory Marshall. Cromwell, Harry C. Harrison. Denmark, G. B. Brackett. Des Moines, Adolphus Voegeli. Dunkerton, J. W. Boyle. Dysart, Jos. Dysart. Elkader, J. N. Hamilton. Fayette, Upper Iowa University. Fort Madison, Miss L. A. McCready. Gillett, H. L. Pierce. Glenwood, Seth Dean. Glenwood, A. Schappel. Grinnell, Prof. S. J. Buck. Hampton, E. C. Grenelle. Humboldt, Miss Florence Prouty. Independence, Emil F. Wulfke. Iowa City, Prof. A. A. Veblen. Iowa City, Iowa Weather Service. Logan, Mrs. M. B. Stern. Manson, W. L. Thompson. Maquoketa, A. B. Bowers. Monticello, H. D. Smith. Mount Pleasant, Dr. Max E. Witte. Mount Vernon, Prof. Alonzo Collin. Muscatine, J. P. Walton. Osage, G. D. Patingill. Osceola, F. M. Kyte. Oskaloosa, Joseph Boyd. *Oskaloosa, O. H. Avey. Sac City, Dr. Caleb Brown.	<b>IOWA—Continued.</b> *Smithland, Dr. Chas. W. Rice. Vinton, T. F. McCune. Washington, Wm. A. Cook. Wesley, Wm. Ward. <b>KANSAS.</b> Allison, John J. Cass. Bendena, G. Campbell. *Cawker City, A. G. Alrich. *Colby, C. E. Bennett. Cunningham, E. Shaw. Elk Falls, Dr. A. C. Williams. *Emporia, Prof. J. H. Dinsmore, Jr. Englewood, C. D. Perry. *Gibson, C. M. Bell. Globe, Wm. Featherston. Havensville, L. W. Dennen. Independence, J. M. Altaffer. La Harpe, Isaac S. Coe. *Lawrence, Prof. F. H. Snow. Lebo, C. W. Burnet. Leoti, L. C. Vickrey. *Manhattan, C. P. Blachley. *Manhattan, F. J. Rogers. Morse, R. P. Edgington. Salina, J. H. Gibson. Santa Fe, Judge A. P. Heminger. Sedan, J. W. Goodell. Topeka, Kansas Weather Service. Tribune, S. B. Jackson. Wakefield, Wm. P. Cochran. Wellington, John H. Wolfe. Yates Centre, F. R. Gray. <b>KENTUCKY.</b> Ashland, J. M. Ferguson. Bernstadt, John Planta. Bowling Green, M. H. Crump. Falmouth, F. G. Held. Frankfort, E. C. Went. Lexington, V. E. Muncey. Louisville, Kentucky Weather Service. Madisonville, T. J. Gill. Millersburgh, C. Pope. Mount Sterling, H. C. McKee. Owensborough, Watkins & Carter. Owenton, J. S. Cox. Pellville, Oscar Haynes. Richmond, Prof. O. A. Kennedy. Shelbyville, H. W. Prissler. South Fork, A. B. Gilbert. <b>LOUISIANA.</b> Cameron, Hon. J. P. Henry. *Convent, Prof. F. Greene. Crowley, A. B. Goodrich. Franklin, T. M. Babington. Grand Coteau, Rev. C. M. Widman. Houma, H. F. Belanger. Liberty Hill, E. A. Crawford. Luling, F. M. Rogers. Mandeville, Hon. Alex. Baird. Marksville, Leon Molinar. Mount Airy (near), Dr. L. D. Chaff. New Iberia, Mrs. J. A. Gilbert. New Orleans, Louisiana Weather Service. *Port Eads, Mrs. C. L. Kleinpeter. Port Eads, Miss Mattie Lawes. Vidalia, L. P. Ault. <b>MAINE.</b> Bar Harbor, Joseph Wood. Cornish, Silas West. *Gardiner, Henry Richards. *Kent's Hill, W. C. Strong. Orono, Prof. M. C. Fernald. <b>MARYLAND.</b> Barren Creek Sp'gs, Albert E. Acworth. Cumberland, E. T. Shriver. Fallston, Prof. G. G. Curtis. Frederick, McClintock Young. Gaithersburgh, John T. De Sellum. Galena, Henry Parr. *Gambrill's, J. E. Moque. Great Falls, Washington Aqueduct. Jewell, Jos. Plummer. McDonogh, McDonogh Institute. M't St. Mary's, M't St. Mary's College. *Woodstock, Woodstock College. <b>MASSACHUSETTS.</b> Amherst, Miss S. C. Snell. Amherst, Massachusetts Agricultural Experimental Station. Blue Hill, Rev. A. K. Teele. Blue Hill Observatory, A. L. Rotch. Cambridge, Harvard College Obs'y.	<b>MASSACHUSETTS—Continued.</b> Deerfield, Rev. A. Hazen. Dudley, Conant Observatory. Fall River, C. V. S. Remington. Heath, B. B. Cutler. Holyoke, J. W. Doran. Leicester, Arthur Kendrick. New Bedford, Thomas R. Rodman. Newburyport, F. V. Pike. North Billerica, C. H. Kohlrausch. Provincetown, John R. Smith. Royalston, Miss Lizzie W. Chase. Somerset, Elisha Slade. Taunton, E. U. Jones, M. D. Westborough, G. S. Newcomb. Williamstown, Williams College Obs'y. Worcester, J. B. Hall. <b>MICHIGAN.</b> Benton Harbor, A. J. McCave. Berrien Springs, F. A. Zerby. Birmingham, S. Alexander. Harrisville, Dr. D. W. Mitchell. Hudson, Major A. H. Boies. Kalamazoo, W. A. Black. Lansing, Dr. H. B. Baker. Lansing, Michigan Weather Service. Marshall, G. H. Greener, M. D. Mottville, J. A. Hartzler. Thornville, John S. Caulkins. Traverse City, S. E. Wait. Ypsilanti, J. C. Bemiss. Ypsilanti, C. S. Woodard. <b>MINNESOTA.</b> Le Sueur, L. B. Davis. Minneapolis, Wm. Cheney. *Minneapolis, Prof. W. A. Pike. Northfield, Minnesota Weather Service. <b>MISSISSIPPI.</b> *Agricultural College, B. W. Kilgore. Kosciusko, L. Heyman. Louisville, B. T. Webster. *Macon, A. T. Dent. Palo Alto, W. H. Hill. Pearlington, C. D. Kock. Pontotoc, C. W. Bolton. Summit, J. N. Teunisson. University, Mississippi Weather Service. Waynesborough, W. S. Daries. <b>MISSOURI.</b> *Conception, Rev. Fr. Paul. Excelsior Springs, A. Reinisch. Fayette, Prof. T. Berry Smith. Frankford, W. W. Vermillion. Grand Pass, E. R. Graham. Lakenan, C. Ayres. New Frankfort, G. W. Hawkins. Ozark, J. J. Brown. Pierce City, J. J. Spilman. Princeton, Wm. Hiron. St. Louis, Missouri Weather Service. Warrenton, Prof. J. H. Frick. <b>MONTANA.</b> Sheldon, P. J. Bond. Virginia City, Eugene Stark. <b>NEBRASKA.</b> Ansley, P. Fowle. *Creighton, Geo. Roberts. Crete, Nebraska Weather Service. Culbertson, G. D. Carrington. *David City, John R. Townsend. De Soto, Chas. Seltz. *Fairbury, Dr. I. Humphrey. Falls City, A. B. Newkirk. Fremont, Isaac E. Heaton. Genoa, Geo. S. Truman. Hay Springs, Wm. Waterman. Kimball, Wm. G. Barton. Lincoln, University of Nebraska. Marquette, John Ellis. North Loup, M. B. C. True. Syracuse, P. W. Rissler. Tecumseh, W. L. Dunlap. Weeping Water, G. Treat. <b>NEVADA.</b> *Carson City, Chas. W. Friend. Carson City, Nevada Weather Service. <b>NEW HAMPSHIRE.</b> Antrim, Frank W. Palmer. Berlin Mills, Q. A. Bridges. Concord, W. L. Foster. Nashua, Chas. H. Webster. North Sutton, C. E. Hosmer. Shaker Village, N. A. Briggs.

*List of voluntary stations of the Signal Service, with their respective observers, who furnish meteorological reports for the Monthly Weather Review—Continued.*

Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.
<b>NEW HAMPSHIRE—Continued.</b>			
Belmont, } Bristol, } Lake Village, } Weir's Bridge, } Wolfeborough, }	Lake Winnepiseogee Cotton and Woollen Manufacturing Co.		
<b>NEW JERSEY.</b>			
Beverly, C. F. Richardson.			
Clayton, W. T. Wilson.			
Egg Harbor City, H. Y. Postma.			
Jersey City, Wright Babcock.			
Moorestown, Thos. J. Beans. [Service.			
New Brunswick, New Jersey Weather			
Readington, John Fleming.			
South Orange, Dr. W. J. Chandler.			
*Vineland, Dr. O. H. Adams.			
<b>NEW MEXICO.</b>			
Coolidge, B. S. Mullin.			
Gallinas Spring, J. E. Whitmore.			
Las Vegas, F. W. Chatfield.			
<b>NEW YORK.</b>			
Angelica, J. P. Slocum.			
Ardentia, Richard B. Arden.			
*Auburn, Geo. Casey.			
Barnes' Corners, W. C. Fawcett.			
Boyd's Corners, Thomas Manning.			
*Brooklyn, Prof. W. C. Peckham.			
Canton, Henry Priest.			
Constableville, R. Sanford Miller.			
Cooperstown, G. Pomeroy Keese.			
Eden, W. P. Hunt.			
Elmira, Gerity Brothers.			
Factoryville, T. P. Yates.			
Fleming, Robt. Warwick.			
Friendship, Jesse D. Rogers.			
Geneva, Mrs. N. S. Yates.			
Hess Road Station, C. H. Spaulding.			
Humphrey, Chas. E. Whitney.			
Iion, G. A. Trowbridge.			
Ithaca, Cornell University.			
Ithaca, New York Weather Service.			
*Johnstown, W. S. Snyder.			
Kingston, H. A. Stone.			
Le Roy, Prof. F. M. Comstock.			
Lowville, W. Hudson Stephens.			
Middleburgh, F. X. Straub.			
Newfane, F. B. Clark.			
*New York, Central Park Observatory.			
Nineveh, W. J. Barnett.			
North Hammond, C. A. Wooster.			
*North Volney, J. M. Patrick.			
Number Four, Chas. Fenton.			
Palmyra, L. D. Cummings.			
Pendleton, W. D. Lovell.			
Penn Yan, Geo. R. Young.			
Perry City (near), W. H. Jeffers.			
Potsdam, Peter Vilas; G. W. F. Smith.			
Queensbury, DeWitt C. Jenkins.			
Salem, W. W. Hance.			
Saranac Lake, Jas. P. Mills.			
Savona, M. S. Collier, M. D.			
Setauket, Selah B. Strong.			
Somerset, J. W. Thurber.			
South Canisteo, J. E. Wilson.			
South Kortright, D. C. Sharpe.			
Utica, Thomas Birt.			
Vermillion, E. B. Bartlett.			
*Waddington, Jos. Graves.			
Wedgewood, O. F. Corwin.			
White Plains, Prof. O. R. Willis.			
<b>NORTH CAROLINA.</b>			
Asheville, Dr. Karl von Ruck.			
<b>NORTH CAROLINA—Continued.</b>			
Chapel Hill, Prof. J. W. Gore.			
Hot Springs, Dr. W. F. Ross.			
Lenoir, Dr. R. L. Beall.			
Raleigh, Thos. C. Harris.			
Raleigh, North Carolina Weather Service.			
Statesville, W. A. Eliason.			
Weldon, T. A. Clark.			
<b>OHIO.</b>			
Bellevue, Wm. Sheffield.			
Cleveland, G. A. Hyde.			
College Hill, John W. Hammitt.			
Collinwood, Wm. Smeed.			
Columbus, Ohio Weather Service.			
Demos, B. B. Ault.			
Elyria, C. W. Goodspeed.			
Garrettsville, S. M. Luther.			
Gracey, H. M. Scott.			
Jacksonborough, Dr. J. B. Owsley.			
Kenton, L. J. Demarest.			
Lordstown, W. S. Dean.			
Napoleon, Dr. T. C. Hunter.			
*New Athens, T. M. Sewell.			
North Lewisburgh, H. D. Govey.			
*Portsmouth, Dr. D. B. Cotton.			
Ruggles, Peter Bowman.			
Tiffin, Rev. T. H. Sonedecker.			
Wauseon, Thos. Mikesell.			
Westerville, Prof. John Haywood.			
West Milton, Luke S. Motte.			
Yellow Springs, Chas. W. Rice.			
<b>OREGON.</b>			
Albany, John Briggs.			
Bandon, Geo. Bennett.			
*East Portland, Dr. Geo. Wigg.			
Eola, Thos. Pearce.			
McMinnville, Prof. W. J. Crawford.			
Mount Angel, Rev. F. Barnabas Held.			
Tillamook, A. P. Wilson.			
<b>PENNSYLVANIA.</b>			
Altoona, Chas. B. Dudley, M. D.			
Blooming Grove, John Grathwohl.			
Catawissa, Robt. M. Graham.			
Corry, Wm. Loveland.			
Drifton, H. D. Miller.			
Dyberry, Theo. Day.			
East Brook, L. E. Stunkard.			
Easton, Dr. J. W. Moore.			
Edinborough, C. F. Sweet.			
Franklin, Joseph Bell.			
Germantown, Thos. Meehan.			
Grampian Hills, Nathan Moore.			
Haverford, H. V. Gummere.			
Le Roy, Geo. W. T. Warburton.			
Meadville, David Logan.			
Meshoppen, Stephen S. Jenkins.			
Mount Joy, E. M. Allen.			
Nisbet, J. S. Gibson.			
Philadelphia, Pennsylvania Weather			
Phillipsburgh, G. F. Dunkle.			
Pleasant Mount, J. D. Brennan.			
Quakertown, J. L. Heacock.			
Reading, C. M. Dechant.			
Salem Corners, T. B. Orchard, M. D.			
State College, Agricultural Experi-			
mental Station.			
Troy, M. Gustin.			
Wellsborough, Hiram D. Deming.			
West Chester, Dr. Jesse C. Green.			
Westtown, Wm. F. Wickersham.			
<b>SOUTH CAROLINA.</b>			
Aiken, Dr. W. H. Geddings.			
Cedar Springs, J. T. Bayerly. [vice.			
Columbia, South Carolina Weather Ser-			
*Conway, J. G. Rogers.			
Kirkwood, Colin Macrae.			
Statesburgh, Dr. W. W. Anderson.			
<b>TENNESSEE.</b>			
Ashwood, Rev. C. F. Williams.			
*Austin, P. B. Calhoun.			
Milan, Dr. M. D. L. Jordan.			
Nashville, State Board of Health.			
Ridgely, F. K. Ferguson.			
<b>TEXAS.</b>			
Austin, Oscar Samostz.			
Baird, D. Richardson.			
Bear Creek Rancho, W. H. Potter.			
Belton, E. A. Sterling.			
Brazoria, H. Stevens.			
Brenham, J. G. Sloan.			
Brownwood, J. F. Mayo.			
*Cedar Hill, J. P. Berry.			
Cleburne, P. J. Norwood.			
College Station, Prof. J. H. Kinealy.			
Colorado, Fred R. Blount.			
Columbia, J. S. Rogers.			
Comanche, E. U. Wiesendanger.			
Coriscana, E. L. Gibson.			
Coriscana, W. H. Hamilton.			
Decatur, H. D. Donald.			
Forestburgh, J. N. Morris.			
Fort Worth, Whit Dryden.			
Gallinas, Lum Woodruff.			
Galveston, Texas Weather Service.			
Granbury, E. H. Snider.			
Houston, A. Hutchinson.			
Huntsville, G. Buckingham.			
Ingersoll, E. T. Page.			
La Grange, Jos. Cottam.			
Lampasas, Dr. C. M. Ramsdell.			
Longview, G. W. Kreech.			
Luling, W. H. Rather.			
Mesquite, Silas G. Lackey.			
Mexia, Chas. F. Mercer.			
New Braunfels, Paul Wipprecht.			
New Ulm, C. Runge.			
Silver Falls, C. M. Tilford.			
Snyder, A. C. Wilmett.			
*Tyler, C. E. Wood.			
Victoria, W. S. Chlmett.			
Waco, W. H. Godber.			
<b>UTAH.</b>			
*Lake Park, F. Blume.			
<b>VERMONT.</b>			
Brattleborough, W. H. Childs.			
Burlington, W. B. Gates.			
*Coventry, W. H. Tibbetts.			
East Berkshire, H. B. Lovering.			
Lunenburg, Dr. Hiram A. Cutting.			
*Manchester, Rev. E. P. Wild.			
Middlebury, S. Holton.			
*Newport, M. B. Trasher.			
Saint Johnsbury, F. Fairbanks.			
Stratford, H. F. J. Scribner.			
<b>VIRGINIA.</b>			
Bird's Nest, C. R. Moore.			
*Christiansburg, H. D. Walters.			
Dale Enterprise, L. J. Heatwole.			
Marion, A. T. Lincoln.			
Petersburgh, Jas. M. Colson, Jr.			
Spottsville, B. W. Jones.			
Summit, J. R. Sim.			
<b>VIRGINIA—Continued.</b>			
University of Va., James Wearmouth.			
*Variety Mills, J. H. Micklem.			
Wytheville, Howard Shriver.			
<b>WASHINGTON TERRITORY.</b>			
Blakeley, R. M. Hoskinson.			
*Tacoma, E. N. Fuller.			
Vashon, Mrs. C. B. Carpenter.			
<b>WEST VIRGINIA.</b>			
Clarksburgh, R. T. Lowndes.			
Hartmonsville, W. C. Tabb.			
Middlebrook, S. F. H. Hewit.			
Parkersburgh, T. G. Field.			
Rockport, R. D. J. Echols.			
Tyler Creek, F. M. Swann.			
*White Sulphur Springs, T. Surber.			
<b>WISCONSIN.</b>			
Cadiz, B. C. Curtis.			
Delavan, George L. Collier.			
Embarras, J. E. Breed.			
Fond du Lac, J. C. Wedge.			
Fredonia, B. H. Meyer.			
Glasgow, Henry M. Crombie.			
Lincoln, A. J. Loose.			
Madison, Washburn Observatory.			
Manitowoc, Miss Clasina Lups.			
Oshkosh, Prof. W. N. Mumper.			
Waucousta, G. H. Yapp.			
*Weston, R. R. Wilkinon.			
<b>FOREIGN.</b>			
Burnside, S. A., Dr. C. J. Hering.			
Grand Turk, W. Indies, Geo. I. Gibbs.			
Guanajuato, Mexico, Met'l Obs'y.			
Hamilton, Bermuda, General Rumb.			
Hastings.			
Killisnoo, Alaska, Jos. Zuboff.			
Leon, Mexico, Prof. M. Leal.			
Mazatlan, Mexico, Leon P. Acosta.			
Mexico, Mexico, Meteorological Obs'y.			
Monterey, Mexico, Dr. Wm. De Rye.			
*Montreal, Quebec, C. H. McLeod.			
New Westminster, B.C., Capt. A. Peck.			
Port au Prince, Hayti, Prof. I. Scherer.			
*Pueblo, Mexico, Catholic Institute.			
Zacatecas, Mexico, Jose A. y Borrill.			
<b>New observers, February, 1889.</b>			
Butler, Ala., B. F. Gilder.			
Greensborough, Ala., M. H. Yerby.			
Elkmont, Ala., D. J. Moore.			
San Bernardino, Cal., A. K. Holt.			
Denver, Colo., Rev. Wm. Forstall, S. D.			
De Smet, Dak., T. H. Ruth.			
Diamond, Ga., Wm. Kimzey.			
Webster, Iowa, C. M. Trumbauer.			
Bonnieville, Ky., W. K. Jameson.			
Willow Springs, Mo., J. A. Key.			
Kennedy, Neb., Mrs. M. G. Erickson.			
Embudo, N. M., Geo. E. Curtis.			
Lyons, N. Y., Dr. M. A. Veeder.			
Mt. Pleasant, N. C., H. L. T. Ludwig.			
Southern Pines, N. C., Prof. E. A. Martin.			
Wake Forest, N. C., Prof. E. G. Beckwith.			
Washington, N. C., J. M. Gallagher.			
Morgantown, N. C., P. P. Lorbacher.			
Kent, Ohio, P. W. Elgner. [Shelby]			
Aqueduct Tower, (Lagonia) Pa., D. I.			
Tuscarora, Pa., R. J. Micky.			
Petersburgh, Pa., J. E. Rooney.			
Brewer's Mine, S. C., L. Woeltze.			
Austin, Tex., Q. C. Smith, M. D.			
La Logia, Mexico, H. Patrick.			
Topolobampo, Mex., Lillian Whitehill.			

*Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for February, 1889.*

<b>Alabama.</b>	<b>California—Cont'd.</b>	<b>Idaho.</b>	<b>Maryland.</b>	<b>Nebraska—Cont'd.</b>	<b>New York—Cont'd.</b>	<b>Texas—Cont'd.</b>
Mount Vernon B'ks.	San Diego Barracks.	Bolsé Barracks.	McHenry, Fort.	Omaha, Fort.	West Point M. A.	Ringgold, Fort.
<b>Arizona.</b>	<b>Colorado.</b>	<b>Sherman, Fort.</b>	<b>Massachusetts.</b>	<b>Robinson, Fort.</b>	Willett's Point.	San Antonio, Post.
Apsche, Fort.	Crawford, Fort.	<b>Illinois.</b>	Springfield Armory.	Sidney, Fort.	<b>Ohio.</b>	<b>Utah.</b>
Bowie, Fort.	Lewis, Fort.	Rock Island Arsenal.	Warren, Fort.	<b>Nevada.</b>	Columbus Barracks.	Du Chesne, Fort.
Huachuca, Fort.	Logan, Fort.	Sheridan, Fort.	<b>Michigan.</b>	*Fort Halleck.	<b>Oregon.</b>	Douglas, Fort.
Lowell, Fort.	Lyons, Fort.	<b>Indian Territory.</b>	Brady, Fort.	McDermitt, Fort.	Klamath, Fort.	<b>Virginia.</b>
McDowell, Fort.	<b>Connecticut.</b>	Gibson, Fort.	Mackinac, Fort.	<b>New Mexico.</b>	<b>Pennsylvania.</b>	Monroe, Fort.
Mojave, Fort.	Trumbull, Fort.	Reno, Fort.	Wayne, Fort.	Bayard, Fort.	Allegheny Arsenal.	Myer, Fort.
San Carlos.	<b>Dakota.</b>	Supply, Fort.	<b>Minnesota.</b>	Seldon, Fort.	Frankfort Arsenal.	<b>Washington Ter.</b>
Verde, Fort.	A. Lincoln, Fort.	<b>Kansas.</b>	Snelling, Fort.	Union, Fort.	<b>Rhode Island.</b>	Spokane, Fort.
Whipple Barracks.	Bennett, Fort.	Hays, Fort.	<b>Missouri.</b>	Wingate, Fort.	Adams, Fort.	Townsend, Fort.
<b>Arkansas.</b>	Buford, Fort.	Leavenworth, Fort.	Jefferson Barracks	<b>New York.</b>	<b>Texas.</b>	Vancouver, Fort.
Hot Springs.	Meade, Fort.	Leavenworth Prison.	Custer, Fort.	Columbus, Fort.	Bliss, Fort.	Walla Walla, Fort.
Little Rock, Barracks.	Pembina, Fort.	Riley, Fort.	<b>Montana.</b>	David's Island.	Brown, Fort.	<b>Wyoming.</b>
<b>California.</b>	<b>California.</b>	<b>Kentucky.</b>	Assinaboine, Fort.	Hamilton, Fort.	Clark, Fort.	Bridger, Fort.
Alcatraz Island.	Sisseton, Fort.	Newport Barracks.	Keogh, Fort.	Madison Barracks.	Concho, Fort.	D. A. Russell, Fort.
Angel Island.	Sully, Fort.	<b>Louisiana.</b>	Maginnis, Fort.	Niagara, Fort.	Davis, Fort.	Laramie, Fort.
Benicia Barracks.	Totten, Fort.	Jackson Barracks.	Missoula, Fort.	Plattsburgh Barracks.	Eagle Pass, Camp.	McKinney, Fort.
Bidwell, Fort.	Yates, Fort.	<b>Maine.</b>	Poplar River, Fort.	Porter, Fort.	Elliott, Fort.	Pilot Butte, Camp.
Gaston, Fort.	<b>Florida.</b>	*Kennebec Arsenal.	Shaw, Fort.	Schuyler, Fort.	Hancock, Fort.	Sheridan, Camp.
Mason, Fort.	Barrancas, Fort.	*Preble, Fort.	<b>Nebraska.</b>	Wadsworth, Fort.	McIntosh, Fort.	Washakie, Fort.
Presidio of San F.	Saint Francis B'ks.		Niobrara, Fort.	Watervliet Arsenal.	Pena Colorado, Camp.	